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UNCLASSIFIED RADC-TR-76-261-VOL-3 NL

1 OF 3
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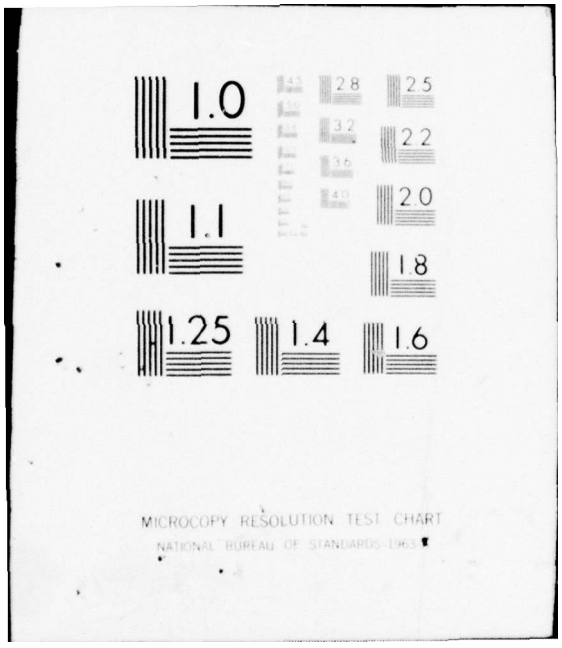
1.0
1.1
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2.5
3.2
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3.6
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1.8
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963

RADC-TR-76-261, Volume III
Final Technical Report
October 1976

SPACE SURVEILLANCE SOFTWARE SUPPORT
Radar Signature and Radar Scattering Principles Investigation Software

PRC Information Sciences Company

ROME AIR DEVELOPMENT CENTER
AIR FORCE SYSTEMS COMMAND
GRIFFISS AIR FORCE BASE, NEW YORK 13441

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Classifiers

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The objective of this effort was to modify the RADC trajectory program, orbit program and various radar cross section programs were modified to run on the RADC HIS 6180 computer under the GCOS system software. The RADC trajectory program was modified to include the capability of processing multiple (20) radar sites and mulitple (20) targets in the program so that various radar parameters could be determined. This type of information is essential in performing radar coverage analyses for systems such as COBRA TALON, SEEK SAIL, COBRA DANE and COBRA JUDY. This portion of the effort is documented in Vol 1.

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Line 20 (continued) Volume ~~II~~ 2 documents a procedure for punching cards in ASCII format and reading the data onto a HP cassette for subsequent plotting with an HP 9820 calculator system.

Vol ~~III~~ 3 documents some Radar Signature and Radar Scattering computer programs. A three-dimensional plot program contained in this volume has been incorporated into the Interactive Radar Simulator for plotting three-dimensional antenna patterns and cross section aspect angle histories.

ABSTRACT

The objective of the effort documented herein was to provide computer programming support for Space Surveillance system analysis. The two primary tasks of the effort were to complete the modification of the RADC Trajectory Program and to modify various radar cross-section and other computer programs so that they could be accessed from the interactive system for the RADC Radar Simulator. The documentation is organized as follows:

Volume I, Part 1, Book 1 - Project Summary and Computer Program Documentation (Chapters I-III of Volume I, Part 1)

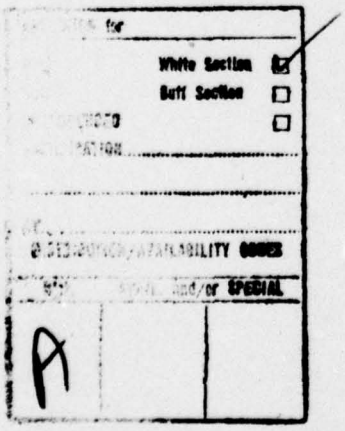
Volume I, Part 1, Book 2 - Computer Program Documentation (Chapter IV)

Volume I, Part 1, Book 3 - Computer Program Documentation (Chapters V-VI and Appendices A-E)

Volume I, Part 2 - RADC Trajectory Program - Numerical/ Analytical Data

Volume II - Generalized Data Entry and Plot Program

Volume III - Radar Signature and Radar Scattering Principles Investigation Software



SECTION I INTRODUCTION

The computer programs documented in this section of the report were originally developed by the Fort Worth Division of General Dynamics, under Contracts F30602-69-C-0164 and F30602-67-C-007. PRC has installed these programs on the RADC HIS 6180 GECOS Time Sharing System. Some of the programs need minor cleaning up since the test expired. Each Roman Numeral Section has its own Table of Contents.

TABLE OF CONTENTS

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SECTION II

SP3D

COMPUTER PROGRAM DOCUMENTATION

TABLE OF CONTENTS

S E C T I O N 1

S C O P E

This specification establishes the requirements for complete identification and acceptance of the computer program to be formally accepted by the procuring agency. EDP program SP3D was originally written by the Convair Aerospace Division of General Dynamics for use with an IBM 360 computer system under contract F30(602)-69-C-0164; however, the necessary changes have been incorporated to make the program compatible with the GE 635/645 computer system at RADC. This documentation has been prepared in accordance with the RADC Computer Program Detail Specification, 28 January 1968.

SECTION 2

APPLICABLE DOCUMENTS

The documents, of exact issue shown, form a part of this specification to the extent specified herein. In the event of conflict between documents referenced here and the detail content of Sections 3, 4, and 5, the detailed contents of Sections 3 through 5 shall be considered as superseding requirements.

1.	GE-600 Line FORTRAN IV	CPB-1006G
2.	GE-600 Line FORTRAN IV Subroutine Libraries	CPB-1620
3.	GE-600 Line General Loader	CPB-1008F
4.	GE-600 Line System Editor	CPB-1138C

SECTION 3

REQUIREMENTS

Computer program SP3D has as its primary function the display, in a psuedo three-dimensional form, of edited short-pulse radar signature data. The program has available several capabilities for use by the customer in displaying this data. These capabilities include the ability to:

1. Select any file on tape to be plotted
2. Select whether to plot amplitude data only or amplitude and phase data
3. Select the number of sweeps displayed
4. Select the oblique skew desired
5. Display data expressed in voltage or decibels.

3.1 CP CHARACTERISTICS

Computer program SP3D, which consists of an executive routine, subroutine SP3D and subroutine DATAIN, is described in detail in the following paragraphs.

3.1.1 CP Flow Chart

Figures 1 and 2 depict the overall flow of the computer program.

3.1.2 CP Timing

Run time for the sample problem was less than 8 minutes.

3.1.3 Storage Allocation

58K is the minimum memory needed to load SP3D with all files open.

3.1.4 Data Base Characteristics

Radar signature input data for this program are contained on 7-track magnetic tape recorded at 556 bpi. Figure 3 contains a detailed description of the tape format.

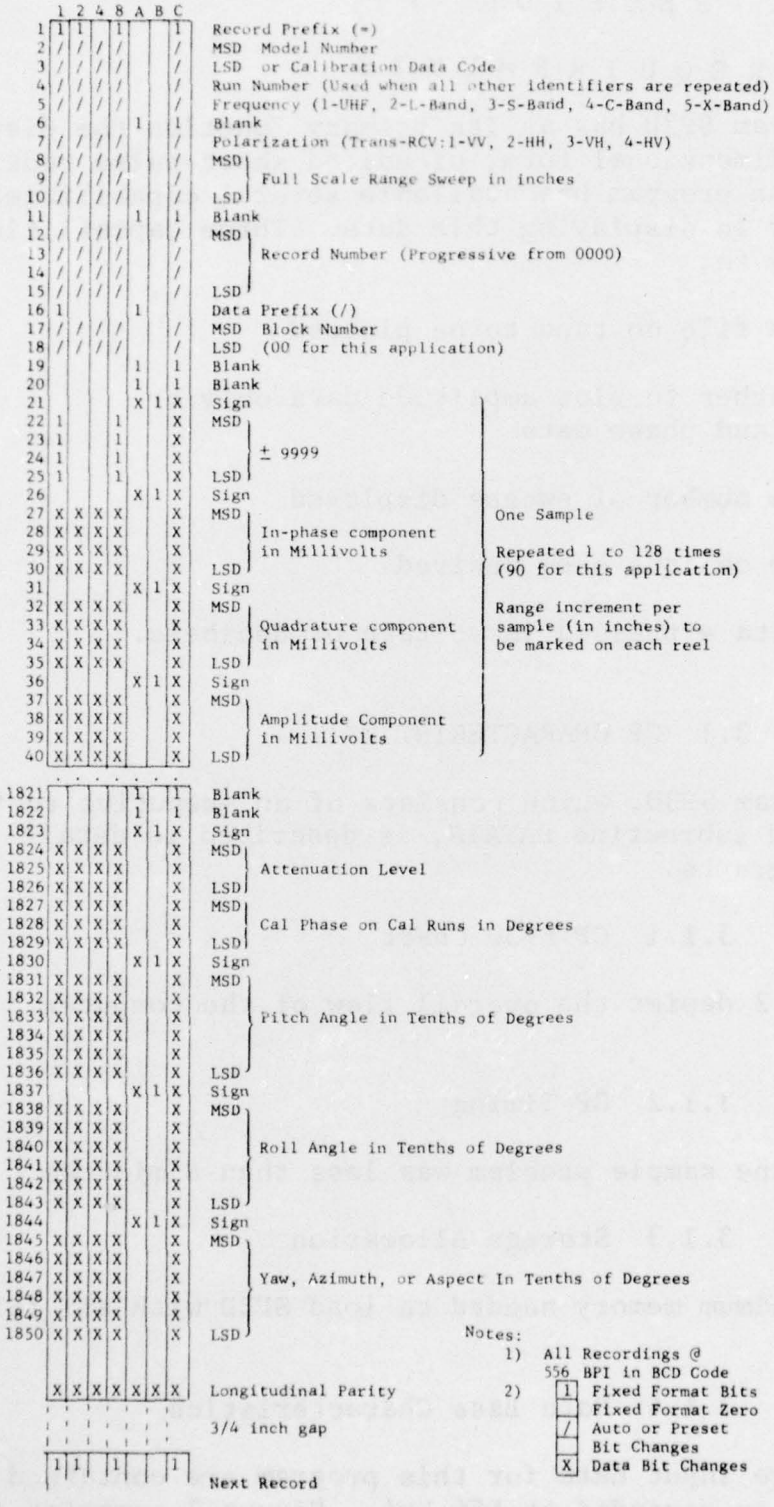


Figure 3 MAGNETIC TAPE FORMAT

3.2 COMPUTER PROGRAM SUBROUTINE CHARACTERISTICS

This paragraph contains the detailed technical descriptions of the computer program subroutines identified in paragraph 3.1 of this specification. The instruction listings contained herein by inclusion or reference specify the exact configuration of SP3D. SP3D is written in FORTRAN Y language for use with the GE 635/645 computer system.

3.2.1 Executive Routine

The executive routine of SP3D is responsible for (1) reading and testing input data for tape and plot control, (2) acquiring and scaling data from tape, (3) determining if the tape is in dB or millivolts, and (4) writing header and trailer information obtained from the second record of each sweep onto a plot frame.

3.2.1.1 Description of Executive Routine

Card input data to SP3D is tested for the correct range of values. If values are found to be outside their permissible range, they are either set to be within the permissible range or execution is halted depending on the variable being tested.

Generally, edited short-pulse magnetic tapes are expressed in millivolts; however, at times it has been desirable to have the amplitude data expressed in dB (relative to saturation). Therefore, FORTRAN logic has been implemented to detect whether tapes to be displayed are expressed in millivolts or dB. This is accomplished by testing the algebraic sign of the amplitude channel data in the first sweep of the first file. If the sign is positive, it indicates that the data is in millivolts; if negative, then the data is expressed in dB. The phase channels are always expressed in millivolts.

A scale factor of (1/500) is chosen when the amplitude response is in millivolts. This produces a maximum display of 20 units in amplitude for each radar signature. For the case in which the amplitude has been calibrated in dB, scaling is accomplished according to

$$\sigma_D = (\sigma_T + \text{YTOP})$$

where

σ_T = Amplitude response read from magnetic tape (in dB)

σ_D = Scaled amplitude response for display

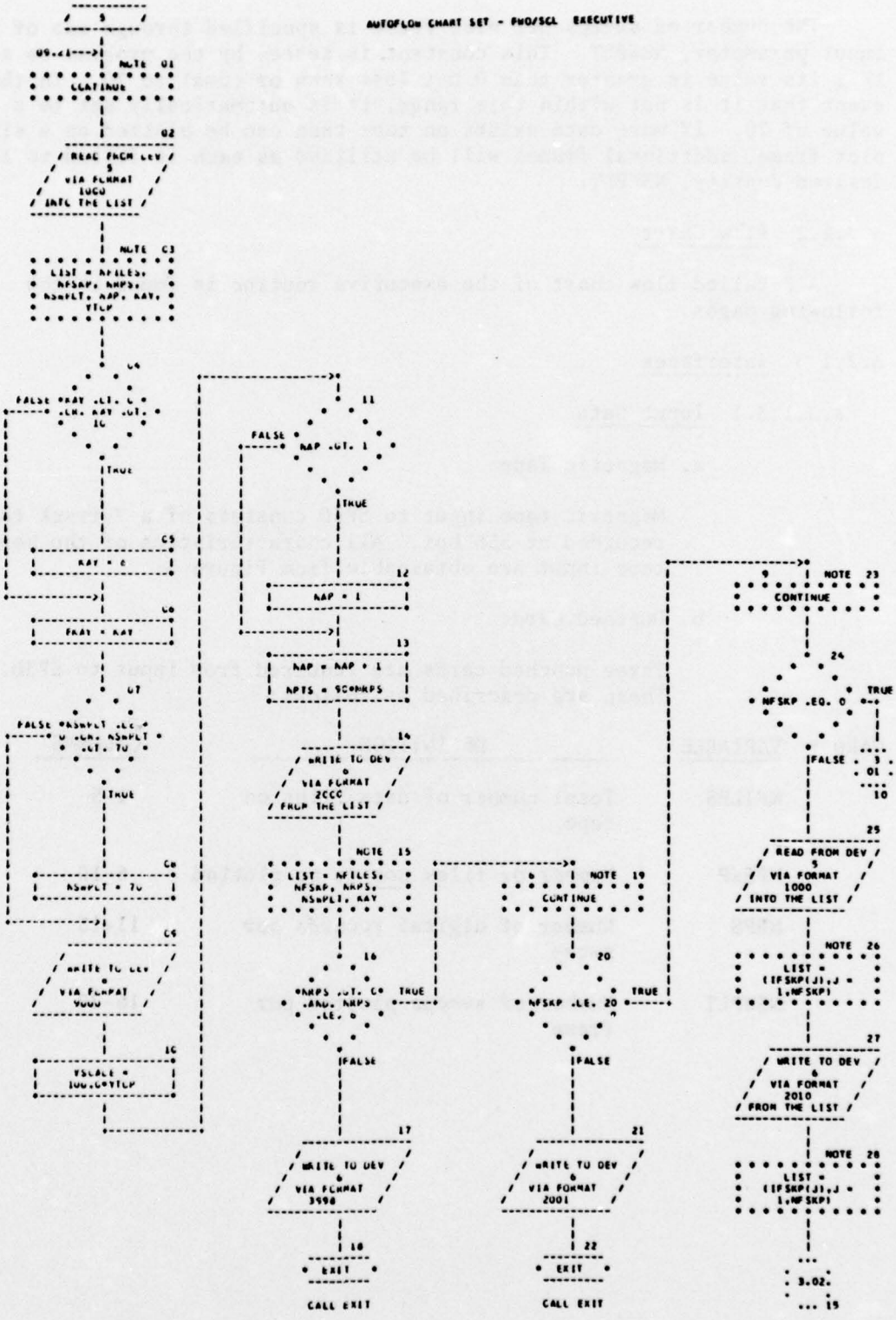
YTOP = User-selected scale factor

The constant, YTOP, is used to "mirror" all amplitude samples to magnitudes greater than zero and is entered into the program via punched cards. If, for example, it is desired to produce a 20 dB dynamic range display of the amplitude response, then the user should enter the value of 20.0 for YTOP. The resulting three-dimensional presentation will consist of analog traces of all amplitudes which were within 20 dB of saturation. Amplitudes which were of lesser magnitude will be displayed at the 20 dB threshold level.

In selecting a value for YTOP, the user should have knowledge of the threshold which was used when the amplitude data was calibrated. That is, if only that data which was within 25 dB of saturation was calibrated, then the value of YTOP should not exceed 25.0 when entered into SP3D. A violation of this practical limit would simply result in a 25 dB dynamic range display of the signatures.

The user of SP3D has, through card input to the executive routine, the option of displaying the scaled amplitude response only, or of displaying both the scaled amplitude response as well as the response which is computed through the use of the two phase components.

The phase response is displayed in the form of $K_p \sqrt{\sigma_I^2 + \sigma_Q^2}$ where K_p has been arbitrarily chosen as (.707/500). The display of this data was made optional since it increases program run time by approximately 40-percent and may not be desired from each magnetic tape. In either case, the user is provided with a complete run log of the information contained on tape. This run log is printed on the plot frame next to the actual plot. This log is in the form of a listing of the header and trailer data obtained from the second record of each sweep. If desired, the user also has the option of skipping any file on tape.


9
GO TO
NOTE 01
CONTINUE
02
READ FROM DEV 5
VIA FORMAT 1000
INTO THE LIST
NOTE 03
LIST = NFILES, NFSKP, NRPS, NSMPLT, NAP, NAY, TTLP
04
FALSE NAY .LT. 1 .OR. NAY .GT. 10
TRUE
05
NAY = 6
06
FRAY = NAY
07
FALSE NSMPLT .LT. 0 .OR. NSMPLT .LT. 70
TRUE
08
NSMPLT = 70
09
WRITE TO DEV 6
VIA FORMAT 9000
10
YSCALE = 100.0*TTLP
11
FALSE NAP .GT. 1
TRUE
12
NAP = 1
13
NAP = NAP + 1
NPTS = 900*NRPS
14
WRITE TO DEV 6
VIA FORMAT 2CCC
FROM THE LIST
NOTE 15
LIST = NFILES, NFSKP, NRPS, NSMPLT, NAY
16
NRPS .GT. 60 .AND. NRPS .LE. 0
TRUE
FALSE
17
WRITE TO DEV 6
VIA FORMAT 3998
18
EXIT
CALL EXIT
6
NOTE 19
CONTINUE
20
NFSKP .LE. 20
TRUE
FALSE
21
WRITE TO DEV 6
VIA FORMAT 2001
22
EXIT
CALL EXIT
9
NOTE 23
CONTINUE
24
NFSKP .EQ. 0
TRUE
FALSE . 9 . . 01 . . 10
25
READ FROM DEV 5
VIA FORMAT 1000
INTO THE LIST
NOTE 26
LIST = (IFSKP(J),J = 1,NFSKP)
27
WRITE TO DEV 6
VIA FORMAT 2010
FROM THE LIST
NOTE 28
LIST = (IFSKP(J),J = 1,NFSKP)
. 3.02.
. 15

The number of sweeps per plot frame is specified through use of the input parameter, NSWPLT. This constant is tested by the program to assure that its value is greater than 0 but less than or equal to 70. In the event that it is not within this range, it is automatically set to a value of 70. If more data exists on tape than can be plotted on s single plot frame, additional frames will be utilized as each is filled to the desired density, NSWPLT.

3.2.1.2 Flow Chart

A detailed flow chart of the executive routine is found in the following pages.

3.2.1.3 Interfaces

3.2.1.3.1 Input Data

a. Magnetic Tape:

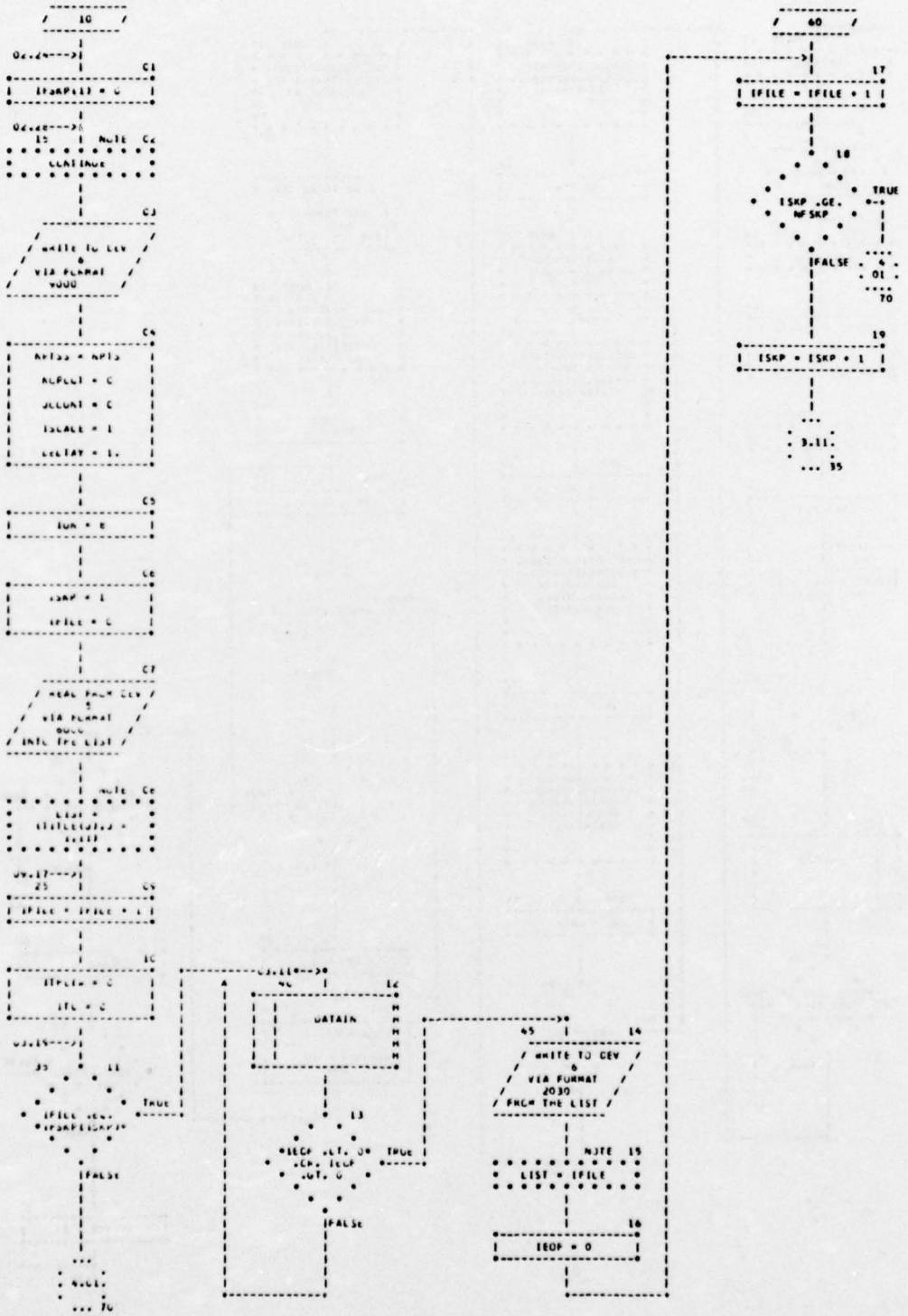
Magnetic tape input to SP3D consists of a 7-track tape recorded at 556 bpi. All characteristics of the magnetic tape input are obtainable from Figure 3.

b. Punched Card:

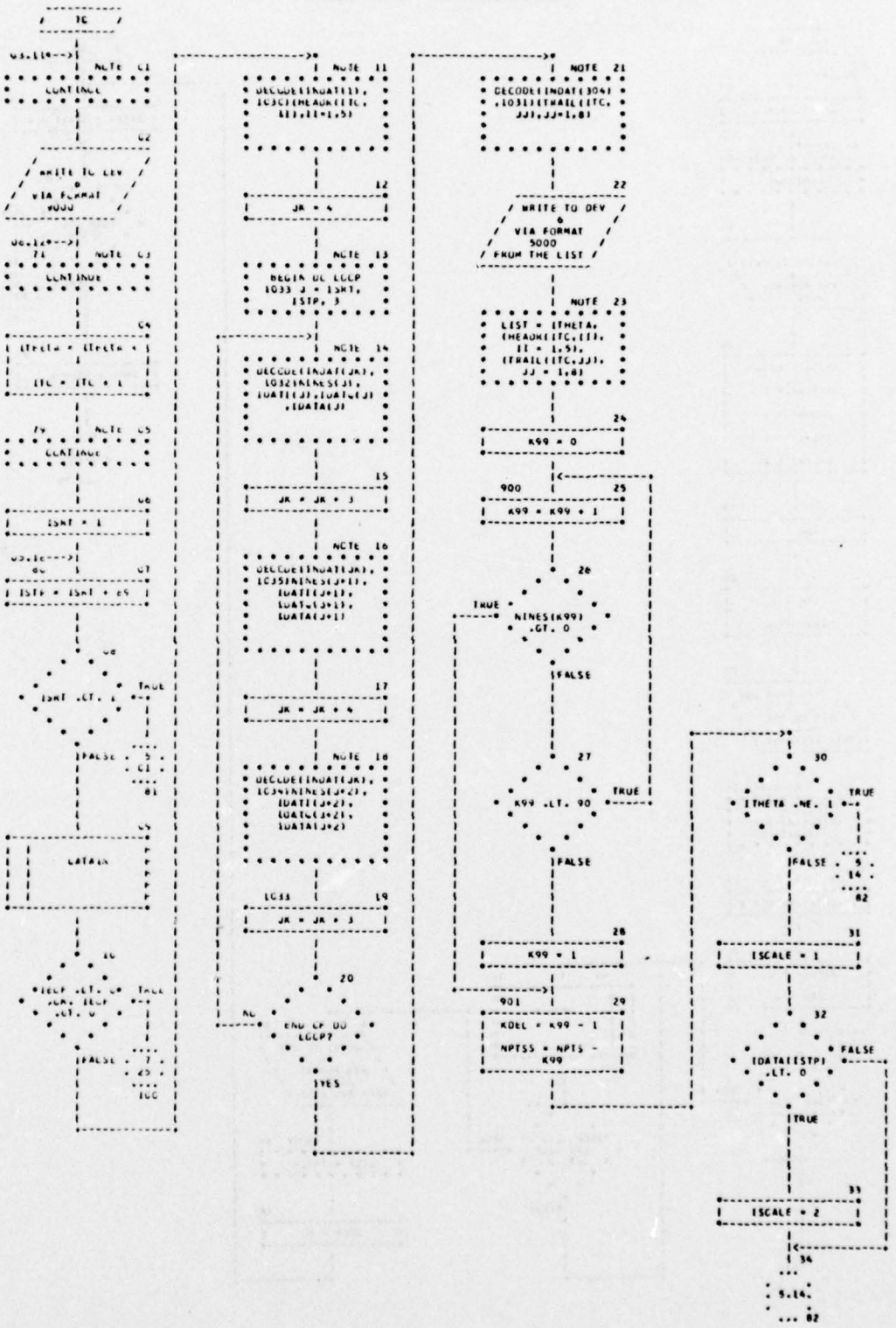
Three punched cards are required from input to SP3D. These are described as follows:

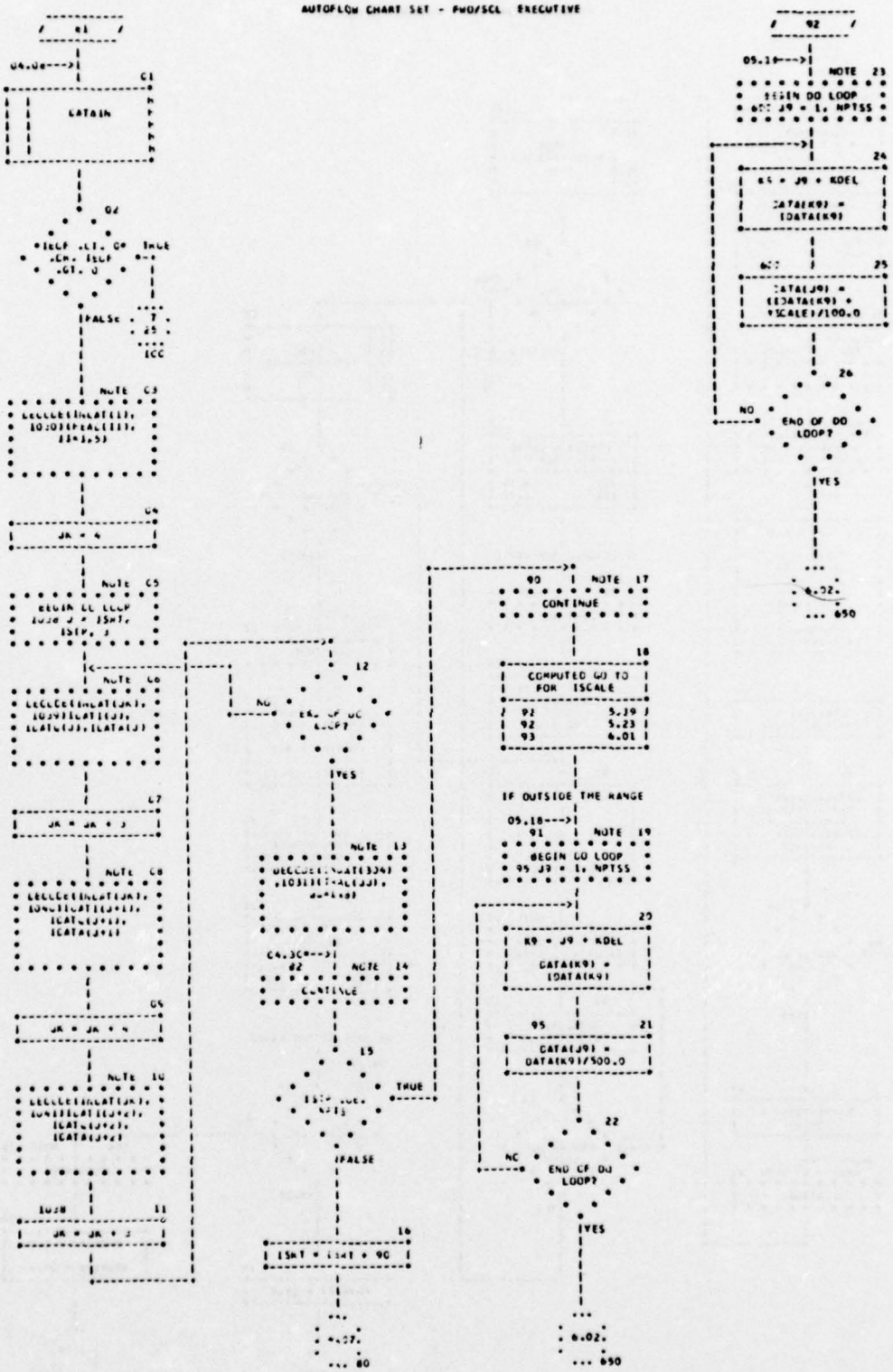
CARD 1	VARIABLE	DEFINITION	COLUMNS
	NFILES	Total number of data files on tape	1-5
	NFSKP	Number of files not to be plotted	6-10
	NRPS	Number of digital records per sweep	11-15
	NSWPLT	Number of sweeps plotted per frame	16-20

AUTOFLOW CHART SET - FWO/SCL EXECUTIVE

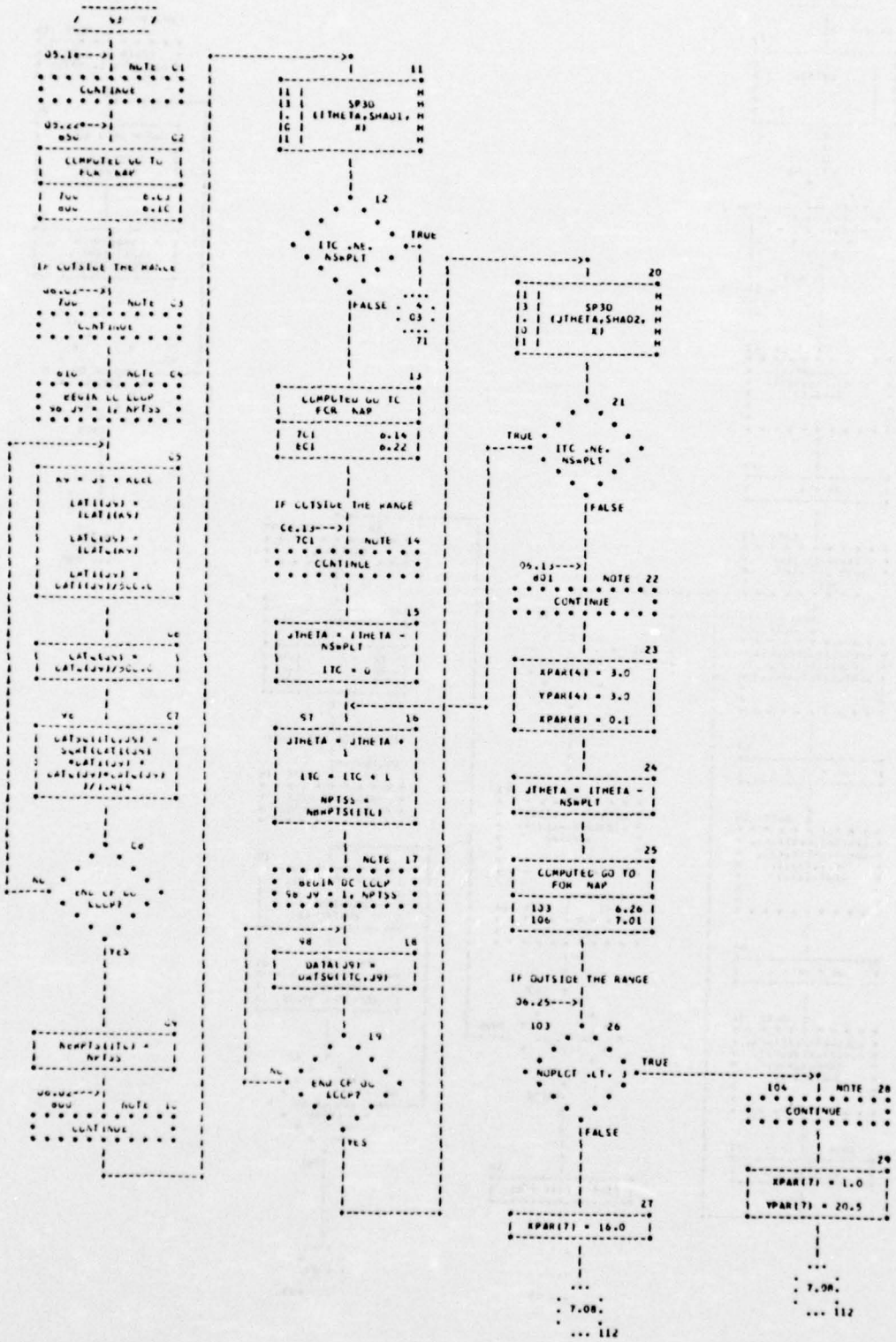


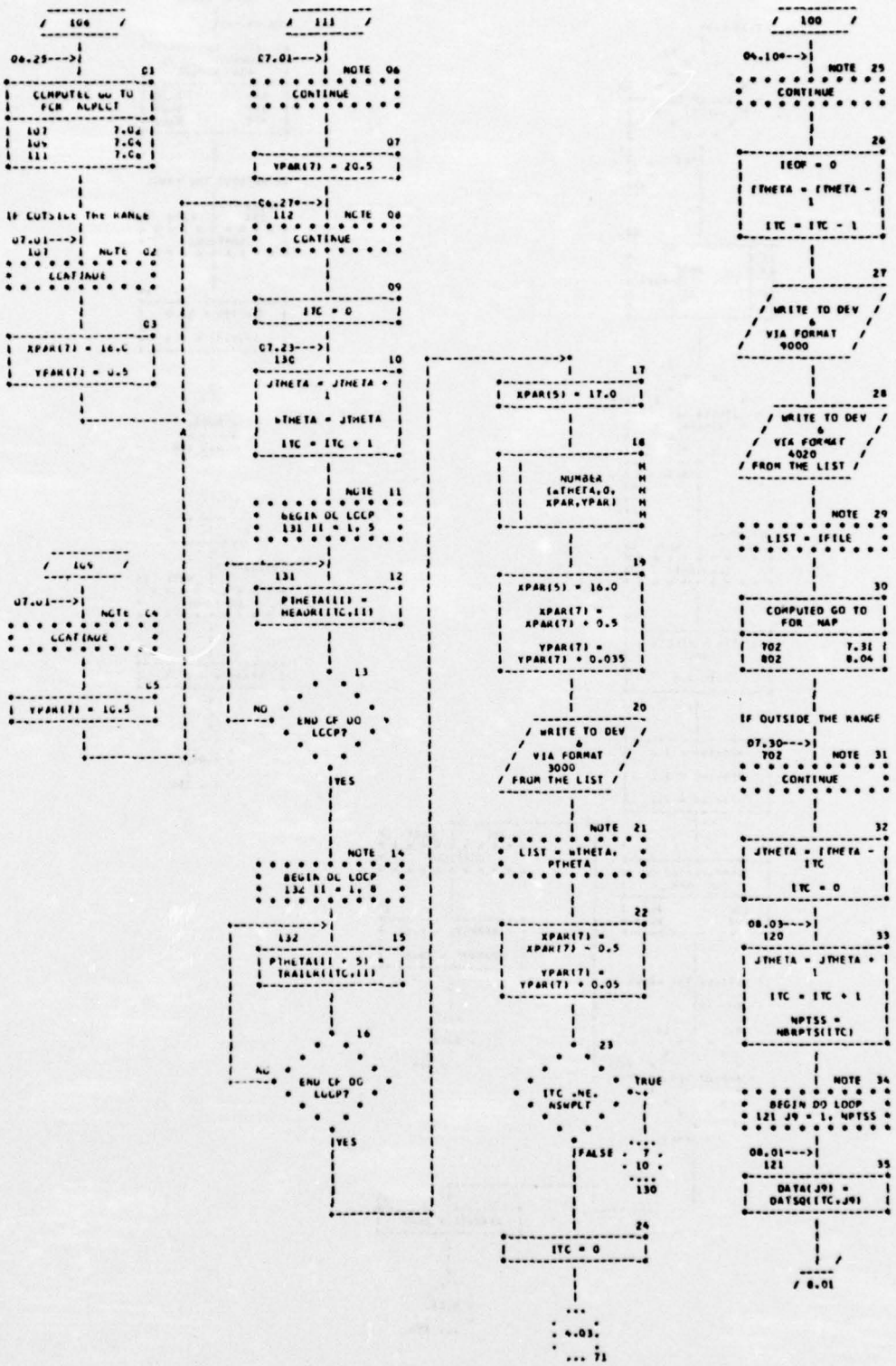
AUTOFLOW CHART SET - FMU/SCL EXECUTIVE

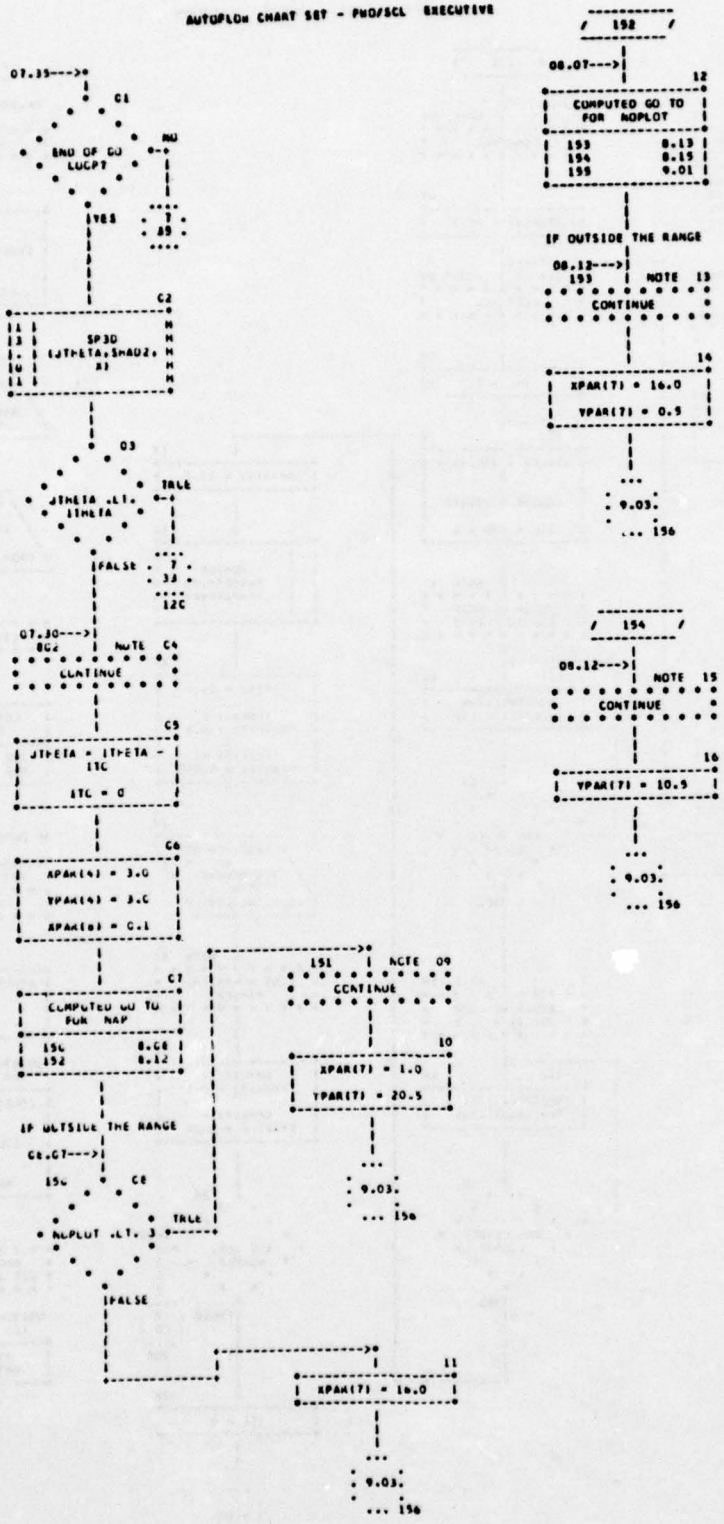


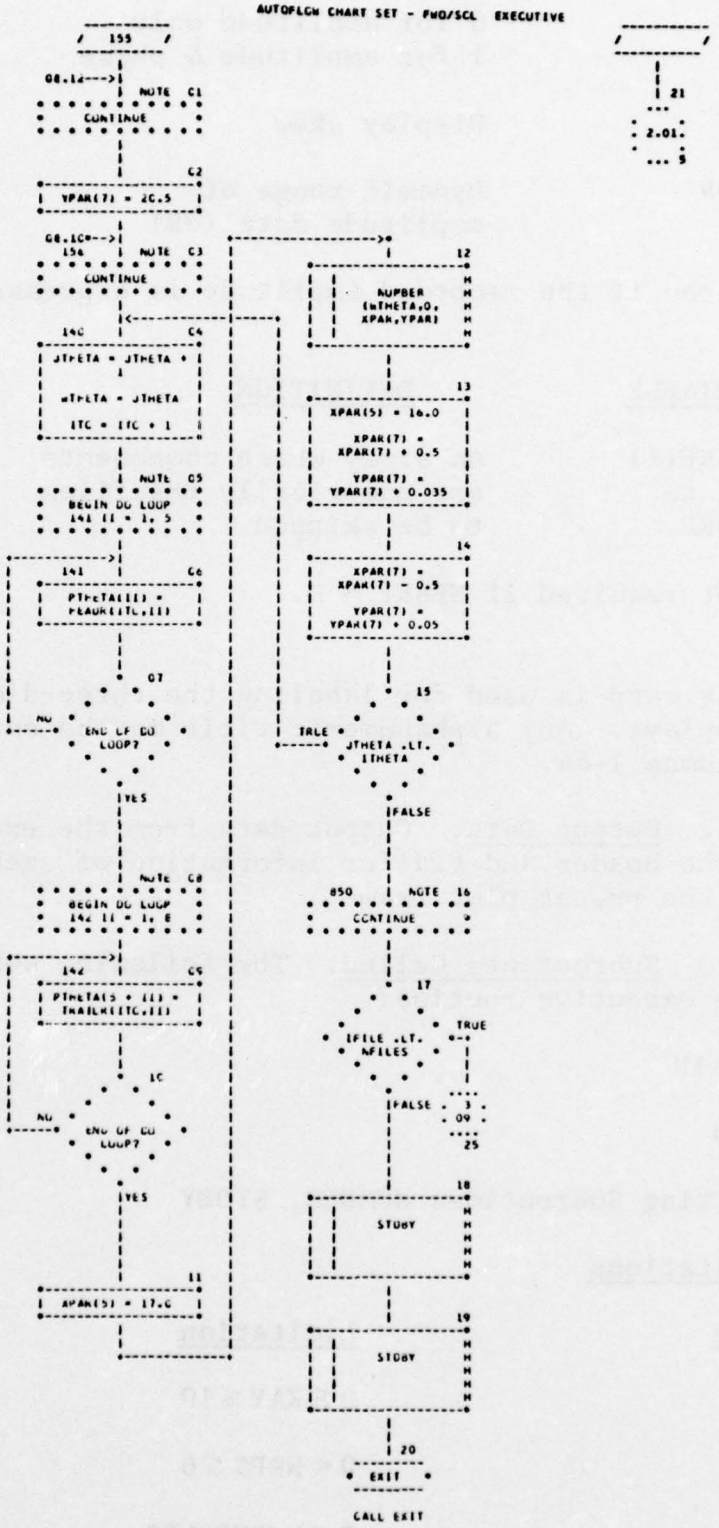

AUTOFLOW CHART SET - FWD/SCL EXECUTIVE
/ 91 /
/ 92 /
CALL IN
NOTE C3
NOTE C5
NOTE C6
NOTE C8
NOTE 10
NOTE 11
NOTE 12
NOTE 13
NOTE 14
NOTE 15
NOTE 16
NOTE 17
NOTE 18
NOTE 19
NOTE 20
NOTE 21
NOTE 22
NOTE 23
NOTE 24
NOTE 25
NOTE 26
COMPUTED GO TO
FOR ISCALE
92 5.39
92 5.23
93 6.01
IF OUTSIDE THE RANGE
CONTINUE
END OF DO LOOP?
TRUE
FALSE
YES
NO
6.02.
6.07.
650
80

AUTOFLOW CHART SET - FWD/SCL EXECUTIVE




/ 106 /
06.25--->
01
COMPUTED GO TO PER ALPLOT
107 7.02
109 7.04
111 7.06
IF OUTSIDE THE RANGE
07.01--->
107
NOTE 02
CONTINUE
03
XPAR(7) = 16.0
YPAR(7) = 0.5
/ 109 /
07.01--->
109
NOTE 04
CONTINUE
05
YPAR(7) = 10.5
/ 111 /
07.01--->
NOTE 06
CONTINUE
07
YPAR(7) = 20.5
06.27--->
112
NOTE 08
CONTINUE
09
ITC = 0
07.23--->
130
10
JTHETA = JTHETA + 1
WTHETA = JTHETA
ITC = ITC + 1
NOTE 11
BEGIN DO LOOP
131 II = 1, 5
131
12
PTHETA(II) = HEADR(ITC,II)
13
NO
END OF DO LOOP?
YES
NOTE 14
BEGIN DO LOOP
132 II = 1, 8
132
15
PTHETA(II + 5I = TRAILR(ITC,II)
16
NO
END OF DO LOOP?
YES
17
XPAR(5) = 17.0
18
NUMBER (WTHETA,0, XPAR,YPAR)
19
XPAR(5) = 16.0
XPAR(7) = XPAR(7) + 0.5
YPAR(7) = YPAR(7) + 0.035
20
WRITE TO DEV 6 VIA FORMAT 3000 FROM THE LIST
NOTE 21
LIST = WTHETA, PTHETA
22
XPAR(7) = XPAR(7) - 0.5
YPAR(7) = YPAR(7) + 0.05
23
ITC .NE. NSWPLT
TRUE
FALSE . 7 . 10 . 130
24
ITC = 0
4.03.
71
/ 100 /
04.10--->
NOTE 25
CONTINUE
26
IEOF = 0
ITHETA = ITHETA - 1
ITC = ITC - 1
27
WRITE TO DEV 6 VIA FORMAT 9000
28
WRITE TO DEV 6 VIA FORMAT 4020 FROM THE LIST
NOTE 29
LIST = IFILE
30
COMPUTED GO TO FOR NAP
702 7.31
802 8.04
IF OUTSIDE THE RANGE
07.30--->
702
NOTE 31
CONTINUE
32
JTHETA = ITHETA - ITC
ITC = 0
08.03--->
120
33
JTHETA = JTHETA + 1
ITC = ITC + 1
NPTSS = NBRPTS(ITC)
NOTE 34
BEGIN DO LOOP
121 J9 = 1, NPTSS
08.01--->
121
35
DATA(J9) = DATSQ(ITC,J9)
/ 8.01


AUTOFLOW CHART SET - PNO/SCL EXECUTIVE
07.35--->
C1
END OF GO LUCPT
NO
YES
7
89
C2
SP3D (JTHETA,SHADZ, XI)
C3
JTHETA .LT. ITHETA
TRUE
FALSE
7
33
120
07.30---> 8G2
NOTE C4
CONTINUE
C5
JTHETA = ITHETA - ITC
ITC = 0
C6
APAR(4) = 3.0
YPAR(4) = 3.0
APAR(8) = 0.1
C7
COMPUTED GO TO FUN NAP
154 8.08
152 8.12
IF OUTSIDE THE RANGE
08.07--->
154
C8
NOPLOT .LT. 3
TRUE
FALSE
151
NOTE 09
CONTINUE
10
XPAR(7) = 1.0
YPAR(7) = 20.5
9.03.
156
11
XPAR(7) = 16.0
152
08.07--->
12
COMPUTED GO TO FOR NOPLOT
153 8.13
154 8.15
155 9.01
IF OUTSIDE THE RANGE
08.13---> 153
NOTE 13
CONTINUE
14
XPAR(7) = 16.0
YPAR(7) = 0.5
9.03.
156
154
08.12--->
NOTE 15
CONTINUE
16
YPAR(7) = 10.5
9.03.
156


AUTOFLOW CHART SET - PWO/SCL EXECUTIVE
155
NOTE C1
CONTINUE
C2
YPAR(7) = 20.5
NOTE C3
CONTINUE
140
C4
JTPETA = JTHETA + 1
WTPETA = JTHETA
ITC = ITC + 1
NOTE C5
BEGIN DO LOOP
141 II = 1, 5
141
C6
PTHETA(II) =
PEAUK(ITC,II)
C7
NO
END OF DO LOOP?
YES
NOTE C8
BEGIN DO LOOP
142 II = 1, 8
142
C9
PTHETA(5 + II) =
TRAILR(ITC,II)
10
NO
END OF DO LOOP?
YES
11
XPAR(5) = 17.0
12
NUMBER
(WTHETA,0,
XPAR,YPAR)
13
XPAR(5) = 16.0
XPAR(7) =
XPAR(7) + 0.5
YPAR(7) =
YPAR(7) + 0.035
14
XPAR(7) =
XPAR(7) - 0.5
YPAR(7) =
YPAR(7) + 0.05
15
TRUE
JTHETA .LT.
ITHETA
FALSE
850
NOTE 16
CONTINUE
17
IFILE .LT.
NFILES
TRUE
FALSE
3
09
25
18
STUDY
19
STUDY
20
EXIT
CALL EXIT
21
2.01
5

CARD 1	VARIABLE	DEFINITION	COLUMNS
	NAP	0 for amplitude only 1 for amplitude & phase	21-25
	KAY	Display skew	26-30
	*YTOP	Dynamic range of amplitude data (dB)	30-40

*YTOP is ignored if the recorded amplitude is expressed in millivolts.

CARD 2	VARIABLE	DEFINITION	COLUMNS
	*IFSKP(i) i=1 to NFSKP	An array whose components are numerically the files to be skipped	1-5, 6-10, etc.

*Card 2 is not required if NFSKP = 0.

CARD 3 This card is used for labeling the three-dimensional displays. Any alphanumeric title may be entered into Columns 1-44.

3.2.1.3.2 Output Data. Output data from the executive routine consists of the header and trailer information of each sweep being written onto the proper plot frame.

3.2.1.3.3 Subroutines Called. The following subroutines are called by the executive routine:

1. DATAIN
2. SP3D
3. Plotting Subroutines NUMBER, STDBY

3.2.1.4 Limitations

Variable	Limitation
KAY	$0 \leq KAY \leq 10$
NRPS	$0 < NRPS \leq 6$
NFSKP	$0 \leq NFSKP \leq 20$
NSWPLT	$0 < NSWPLT \leq 70$

All fixed point variables on input must be right adjusted.

3.2.1.5 Listing

A listing of the executive routine is found in the following pages.

3.2.2 Computer Program Subroutine SP3D

Subroutine SP3D has as its primary functions (1) the selectio of points to be plotted and (2) skewing and plotting of the data. Subroutine SP3D is written in FORTRAN IV language for use with the GE 635/645 computer system at RADC.

3.2.2.1 Description of Subroutine SP3D

In subroutine SP3D, all sweeps except for the first of each plot frame are shifted in the X and Y directions. The input variable KAY provides the horizontal displacement per unit vertical displacement.

The first sweep of each plot frame is plotted in its entirety The points of each successive sweep are tested to see if they will be plotted. The criteria used for the selection is such that if the point under consideration (after being shifted) is less than or equal to the point immediately below it in the previous sweep then the point shall not be plotted. Figure 4 illustrates this technique in a blown up portion of a sweep. Plotting is accomplis by using standard RADC plotting routines.

3.2.2.2 Subroutine SP3D Flow Chart

A detailed flow chart of subroutine SP3D is contained in the following pages.

3.2.2.3 Interfaces

3.2.2.3.1 Input. Input to subroutine SP3D consists of (1) the variables in common blocks 1, 2, 3, 4 and (2) the variables ITHETA, SHADOW, and X which are transferred through the subroutine argument list.

3.2.2.3.2 Output. The output of subroutine SP3D consists of the three-dimensional plot of the radar signature data.

```
C         MAIN - SP3D  7090                3
      COMMON/BLOCK1/NPTS,NPTSS,ITC,KAY,DELTAY,DATA(540)
      COMMON /BLOCK2/ XU, YL, YU, TITLE(11)
      COMMON /BLOCK3/ NOPLOT, FKAY, NAP
      COMMON /BLOCK4/ XPAR(8), YPAR(8)
      COMMON /BLOCK5/  X(600), SMAD1(600), SMAD2(600)
      COMMON /INPUT/ INDAT(309),IEOF
      DIMENSION       IFSKP(20)      ,
     1IDATI(540)     ,IDATQ(540)     ,IDATA(540)     ,
     2 DATI(540)     , DATQ(540)     ,DATSQ(70,540)
C
      DIMENSION
     3HEADR(100,5)   ,TRAIL(100,8)   ,HEAD(5)        ,TRAL(8)
C
      DIMENSION NINES(90) ,NBRPTS(100)
      DIMENSION PTHETA(13)
C
    5 CONTINUE
C
      READ (5,1000) NFILES, NFSKP, NRPS, NSWPLT, NAP, KAY   ,YTOP
 1000 FORMAT ( 6I5,F10.0)
      IF ( KAY .LT.    .OR.  KAY .GT. 10 )    KAY = 6
      FKAY = KAY
      IF( NSWPLT .LE. 0 .OR. NSWPLT .GT.  70 ) NSWPLT =  70
      WRITE (6,9000)
      YSCALE = 100.0* YTOP
      IF( NAP .GT. 1 ) NAP = 1
      NAP = NAP + 1
      NPTS = 90*NRPS
      WRITE (6,2000) NFILES, NFSKP, NRPS, NSWPLT  ,KAY
 2000 FORMAT (10H NFILES = ,I3,10H NFSKP  = ,I3,
     1/       10H NRPS   = ,I3,10H NSWPLT = ,I3,
     2/       10H KAY    = ,I3
     3)
      IF( NRPS .GT.   .AND. NRPS .LE. 6 ) GO TO 6
      WRITE (6,3998)
 3998 FORMAT (25H NWDS  NE  TO  90,..,540  )
      CALL EXIT
    6 CONTINUE
C
      IF( NFSKP .LE. 20)GO TO 9
      WRITE (6,2001)
 2001 FORMAT (15H NFSKP .GT. 20 )
      CALL EXIT
    9 CONTINUE
C
      IF( NFSKP .EQ. 0 ) GO TO 10
      READ  (5,1000 )( IFSKP(J),J=1,NFSKP )
      WRITE (6,2010 )( IFSKP(J),J=1,NFSKP )
 2010 FORMAT (21H FILES TO BE SKIPPED , /, 1H ,10(2X,I5) )
      GO TO 15
   10 IFSKP(1) = 0
```

```
   15 CONTINUE
C
      WRITE (6,9000)
 9000 FORMAT(///)
C
C
C
C
C
      NPTSS = NPTS
      NOPLOT = 0
      JCOUNT = 0
      ISCALE = 1
      DELTAY = 1.
C
      IUN = 8
C
      ISKP  = 1
      IFILE = 0
C
C
      READ  (5,6000) ( TITLE(J),J=1,11 )
 6000 FORMAT( 12A4 )
C
C
   25 IFILE = IFILE + 1
C
C
C
C
      ITHETA = 0
      ITC= 0
   35 IF( IFILE .EQ. IFSKP(ISKP) ) GO TO 40
      GO TO 70
C
   40 CALL DATAIN
      IF (IEOF .LT. 0  .OR. IEOF .GT. 0)  GO TO 45
      GO TO 40
C
C
   45 WRITE (6,2030) IFILE
 2030 FORMAT (16H BYPASSED FILE  , I2 )
      IEOF = 0
      GO TO 60
C
   60 IFILE = IFILE + 1
      IF( ISKP .GE. NFSKP ) GO TO 70
       ISKP = ISKP + 1
       GO TO 35
C
   70 CONTINUE
      WRITE (6,9000)
```

```
   71 CONTINUE
      ITHETA = ITHETA + 1
      ITC=ITC+1
   79 CONTINUE
      ISRT = 1
   80 ISTP = ISRT + 89
      IF( ISRT .GT. 1 ) GO TO 81
C
       CALL     DATAIN
      IF (IEOF .NE. 0  .OR. IEOF .GT. 0)  GO TO 100
      DECODE(INDAT(1),1030)(HEADR(ITC,II),II=1,5)
 1030 FORMAT(5A4)
      JK=4
      DO 1033 J=ISRT,ISTP,3
      DECODE (INDAT(JK),1032)NINES(J),IDATI(J),IDATQ(J),IDATA(J)
 1032 FORMAT(2X,4I5)
      JK=JK+8
      DECODE(INDAT(JK),1035)NINES(J+1),IDATI(J+1),IDATQ(J+1),IDATA(J+1)
 1035 FORMAT(4X,4I5)
      JK=JK+4
      DECODE(INDAT(JK),1034)NINES(J+2),IDATI(J+2),IDATQ(J+2),IDATA(J+2)
 1034 FORMAT(4I5)
 1033  JK=JK+3
      DECODE(INDAT(JK),1031)(TRAIL(ITC,JJ),JJ=1,8)
 1031 FORMAT(4X,8A4)
      WRITE (6,5000) ITHETA,(HEADR(ITC,II),II=1,5),
     1                      (TRAIL(ITC,JJ),JJ=1,8)
 5000 FORMAT ( 7H SWEEP(,I3, 7H )      ,5A4, 3X,8A4)
      K99 = 0
  900 K99 = K99 + 1
      IF( NINES(K99) .GT. 0 ) GO TO 901
      IF( K99 .LT. 90 ) GO TO 900
      K99 = 1
  901 KDEL = K99 - 1
      NPTSS = NPTS -K99
      IF ( ITHETA .NE. 1 )   GO TO 82
      ISCALE = 1
      IF (IDATA(ISTP) .LT. 0)  ISCALE = 2
C
      GO TO 82
C
   81 CALL DATAIN
      IF (IEOF .NE. 0  .OR. IEOF .GT. 0)  GO TO 100
      DECODE(INDAT(1),1030)(HEAD(II),II=1,5)
      JK=4
      DO 1038 J=ISRT,ISTP,3
      DECODE (INDAT(JK),1039)          IDATI(J),IDATQ(J),IDATA(J)
 1039 FORMAT(7X,3I5)
      JK=JK+3
      DECODE(INDAT(JK),1040)           IDATI(J+1),IDATQ(J+1),IDATA(J+1)
 1040 FORMAT(9X,3I5)
      JK=JK+4
```

```
      DECODE(INDAT(JK),1041)          IDATI(J+2),IDATQ(J+2),IDATA(J+2)
 1041 FORMAT(5X,3I5)
*1088  JK=JK+3
      DECODE(INDAT(304),1081)(TRAL(JJ),JJ=1,8)
   82 CONTINUE
      IF( ISTP .GE. NPTS ) GO TO 90
      ISRT = ISRT + 90
      GO TO 80
C
C
   90 CONTINUE
      GO TO (91,92,93), ISCALE
   91 DO 95  J9 = 1,NPTSS
      K9 = J9 + KDEL
      DATA(K9) = IDATA(K9)
   95 DATA(J9) =  DATA(K9)/5000.0
      GO TO 650
C
   92 DO 600  J9 = 1,NPTSS
      K9 = J9 + KDEL
      DATA(K9) = IDATA(K9)
  600 DATA(J9) = (DATA(K9) + YSCALE)/100.0
      GO TO 650
   93 CONTINUE
C
  650 CONTINUE
      GO TO (700,800), NAP
C
  700 CONTINUE
C
  610 DO 96  J9 = 1,NPTSS
      K9 = J9 + KDEL
      DATI(J9) =  IDATI(K9)
      DATQ(J9) =  IDATQ(K9)
      DATI(J9) =   DATI(J9)/500.0
      DATQ(J9) =   DATQ(J9)/500.0
   96 DATSQ(ITC,J9) = SQRT(DATI(J9)*DATI(J9) + DATQ(J9)*DATQ(J9) )/1.414
      NBRPTS(ITC) = NPTSS
C
  800 CONTINUE
C
C
C
      CALL SP3D( ITHETA   , SHAD1    ,X      )
C
      IF( ITG .NE. NSWPLT ) GO TO 71
C
      GO TO (701,801),NAP
C
  701 CONTINUE
C
      JTHETA = ITHETA - NSWPLT
```

```
      ITC = 0
   97 JTHETA = JTHETA + 1
      ITC = ITC + 1
      NPTSS = NBRPTS(ITC)
      DO 98 J9=1,NPTSS
   98 DATA(J9) = DATSQ(ITC,J9)
C
      CALL SP3D( JTHETA    , SHAD2     ,X       )
C
C
      IF( ITC .NE. NSWPLT) GO TO 97
C
  881 CONTINUE
C
C
      XPAR(4) = 3.0
      YPAR(4) = 3.0
      XPAR(8) = 0.1
C
      JTHETA = ITHETA - NSWPLT
      GO TO (103,106) , NAP
  103 IF (NOPLOT .LT. 3)  GO TO 104
      XPAR(7) = 16.
      GO TO 112
  104 CONTINUE
      XPAR(7) = 1.0
      YPAR(7) = 2 .5
      GO TO 112
  106 GO TO  (107,109,111) , NOPLOT
  107 CONTINUE
      XPAR(7) = 16.
      YPAR(7) = 0.5
      GO TO 112
  109 CONTINUE
      YPAR(7) = 1 .5
      GO TO 112
  111 CONTINUE
      YPAR(7) = 2 .5
  112 CONTINUE
      ITC = 0
  130 JTHETA = JTHETA + 1
      WTHETA = JTHETA
      ITC = ITC + 1
C
      DO 131 II = 1,5
  131 PTHETA(II) = HEADR(ITC,II)
      DO 132  II = 1,8
  132 PTHETA(II+5) = TRAIL(ITC,II)
      XPAR(5) = 17.
      CALL NUMBER (WTHETA ,  ,  , XPAR , YPAR )
C
      XPAR(5) = 16.
```

```
      XPAR(7) = XPAR(7) + 6.5
      YPAR(7) = YPAR(7) + 0.035
C
      WRITE (6,3000)  WTHETA, PTHETA
 3000 FORMAT (1H ,F5.1,5X,13A4 )
C
      XPAR(7) = XPAR(7) - 6.5
      YPAR(7) = YPAR(7) + 0.05
C
      IF( ITC .NE. NSWPLT) GO TO 130
C
      ITC = 0
      GO TO 71
C
C
  100 CONTINUE
      IEOF = 0
      ITHETA = ITHETA + 1
      ITC = ITC + 1
      WRITE (6,9000)
      WRITE (6,4020) IFILE
 4020 FORMAT (23H COMPLETED DATA FILE ( , I2,2H ) )
C
C
C
      GO TO (702,802),NAP
  702 CONTINUE
C
      JTHETA = ITHETA - ITC
      ITC = 0
  120 JTHETA = JTHETA + 1
      ITC = ITC + 1
      NPTSS = NBRPTS(ITC)
      DO 121 J9=1,NPTSS
  121 DATA(J9) = DATSQ(ITC,J9)
      CALL SP3D( JTHETA    , SHAD2     ,X      )
C
C
      IF( JTHETA .LT. ITHETA ) GO TO 120
C
  802 CONTINUE
C
      JTHETA = ITHETA - ITC
      ITC = 0
C
      XPAR(4) = 3.0
      YPAR(4) = 3.0
      XPAR(8) = 0.1
      GO TO  (150,152) , NAP
  150 IF (NOPLOT .LT. 3)  GO TO 151
      XPAR(7) = 16.0
      GO TO 156
```

```
  151 CONTINUE
      XPAR(7) =  1.
      YPAR(7) = 2 .5
      GO TO 156
  152 GO TO (153,154, 155) ,NOPLOT
  153 CONTINUE
      XPAR(7) = 16.
      YPAR(7) = 0.5
      GO TO 156
  154 CONTINUE
      YPAR(7) = 1 .5
      GO TO 156
  155 CONTINUE
      YPAR(7) = 2 .5
  156 CONTINUE
  140 JTHETA = JTHETA + 1
      WTHETA = JTHETA
      ITC = ITC + 1
C
      DO 141 II = 1,5
  141 PTHETA(II) = HEADR(ITC,II)
      DO 142  II = 1,8
      I1 = 5 + II
  142 PTHETA(I1) = TRAIL(ITC,II)
      XPAR(5) = 17.
C
      CALL NUMBER (WTHETA, 0 , XPAR, YPAR )
C
      XPAR(5) = 16.
      XPAR(7) = XPAR(7) + .5
      YPAR(7) = YPAR(7) + 0.035
      WRITE (6,300)  WTHETA, PTHETA
C
      XPAR(7) = XPAR(7) - .5
      YPAR(7) = YPAR(7) + 0.5
C
      IF( JTHETA .LT. ITHETA ) GO TO 140
C
  850 CONTINUE
C
      IF( IFILE .LT. NFILES ) GO TO 25
C
C
C
      CALL STDBY
      CALL STDBY
      CALL EXIT
      GO TO 5
C
      END
      BLOCK DATA
      COMMON /BLOC4/ XPAR(8), YPAR(8)
```

```
      DATA XPAR / 0.0, 29.3, 120, 1.0, 16.0, 0.0, 12.0, 0.3 /
      DATA YPAR / 0.0, 29.0, 0.45, 1.0, 12.0, 0.0, 0.1, 0.0 /
      END
      SUBROUTINE SP3D( ITHETA   ,SHADOW   ,X    )
      COMMON/BLOCK1/NPTS,NPTSS,ITC,KAY,DELTAY,DATA(540)
      COMMON /BLOCK2/ XU, YL, YU, TITLE(11)
      COMMON /BLOCK3/ NOPLOT, FKAY, NAP
      COMMON /BLOCK4/ XPAR(8), YPAR(8)
C
      DIMENSION       X(600) ,    YY(600)    ,SHADOW(600)   ,DATAC(600)
C
      FTHETA = ITHETA - 1
      IF( ITC .NE. 1 ) GO TO 40
      L1 = NPTSS + 1
      L2 = NPTS  + 10
      DO 20 L = 1,L2
      A2 = L - 1
      X(L) = A2 * 0.01
      SHADOW(L) = DATA(L) * FTHETA * DELTAY
   20 CONTINUE
      NOPLOT = NOPLOT + 1
   21 IF (NOPLOT .NE. 1)  GO TO 22
      WRITE (6,1000)  TITLE
 1000 FORMAT (11A4)
   22 CONTINUE
      GO TO (23,31) , NAP
   23 GO TO (26,27,28, 27,29), NOPLOT
   26 XPAR(4) = 100.0
      YPAR(4) = 20.0
      GO TO 36
   27 YPAR(3) = 10.5
      GO TO 36
   28 XPAR(3) = 16.0
      YPAR(3) = 0.5
      XPAR(4) =100.0
      YPAR(4) =20.0
      GO TO 36
   29 CALL STDBY
      YPAR(3) = 0.5
      XPAR(4) = 1.0
      YPAR(4) = 1.0
      XPAR(7) = 12.0
      YPAR(7) = 0.1
      XPAR(8) = 0.3
      NOPLOT = 1
      GO TO 21
C
   31 GO TO (26,33,34,35), NOPLOT
   33 YPAR(3) = 10.5
      GO TO 26
   34 YPAR(3) = 20.5
      GO TO 26
```

```
   35 CALL STDBY
      YPAR(3) =  .5
      XPAR(4) =  1.
      YPAR(4) =  1.
      XPAR(7) = 12.
      YPAR(7) =  .1
      XPAR(8) =  .3
      NOPLOT = 1
      GO TO 21
C
C
   36 CONTINUE
      LPTS = NPTSS - 1
C
      CALL LINE ( X, SHADOW , LPTS, XPAR, YPAR)
      DO 30  L = L1, L2
      SHADOW(L) = 0.
      A2 = L - 1
      X(L) = A2 * 0.01
   30 CONTINUE
      RETURN
C
   40 CONTINUE
      L2 = NPTS + 1
      DO 41 L =  1, L2
      X(L) = X(L) + FKAY*0.01
   41 CONTINUE
      IRJJ = 0
      IR   = 0
      DELTA = FTHETA * DELTAY
   50 CONTINUE
      ICTJ = 0
      ICTK = 0
      IR = IR + 1
      DATAC(IR) = DATA(IR) + DELTA
      IR1 = IR + KAY
      IF ( DATAC(IR) .LT. SHADOW(IR1) )  GO TO 60
      ICTK = 0
      IRJJ = IR
  100 ICTK = ICTK + 1
      YY(IR) = DATAC(IR)
      SHADOW(IR) = YY(IR)
      IF( IR .GE. NPTSS) GO TO 60
      IR = IR + 1
      DATAC(IR) = DATA(IR) + DELTA
      IR1 = IR + KAY
      IF ( DATAC(IR) .GE. SHADOW(IR1) )  GO TO 100
   60 ICTJ = ICTJ + 1
      IF ( ICTJ .EQ. 1  .AND.  ICTK .GT. 1 )  GO TO 70
      GO TO 91
   70 IRADJ  = IRJJ - 1
      DO 80  IJK = 1, ICTK
```

```
      IJK1 = IR + KAY
      YY(IJK) = YY(IJK1)
      X (IJK) =  X(IJK1)
   80 CONTINUE
      LPTS = ICTK - 1
      CALL LINE ( X,   YY    , LPTS, XPAR, YPAR)
      DO 90 IJK = 1,ICTK
      A1 = IJK-1  * (ITC - 1)*KAY
      X(IJK) = A1 * 0.01
   90 CONTINUE
   91 CONTINUE
      IF( IR .LT. NPTSS) GO TO 110
      GO TO 120
  110 IR1 = IR + KAY
      SHADOW(IR) = SHADOW(IR1)
      GO TO 50
  120 RETURN
      END
       SYMDEF   DATAIN
       BLOCK    INPUT
INDAT  BSS      309
IEOF   BSS      1
       USE      PREVIOUS
DATAIN SAVE
       LDA      DCW1
       STA      DCW
       MME      GEINOS
       RTD
       ZERO     FA,DCW
       ZERO     STATR
       MME      GEROAD
       LDA      STATR
       ANA      =0770000000000
       CMPA     =0040000000000
       TZE      EOF
       LDA      =0,DL
       TRA      RETURN
EOF    LDA      =1,DL
RETURN STA      IEOF
       RETURN   DATAIN
FA     BCI      1,000008
STATR  BSS      2
DCW1   IOTD     INDAT,309
DCW    BSS      1
       END
    3     1     6    7       0     6
    1
  ER3D  TAPE  TEST
```

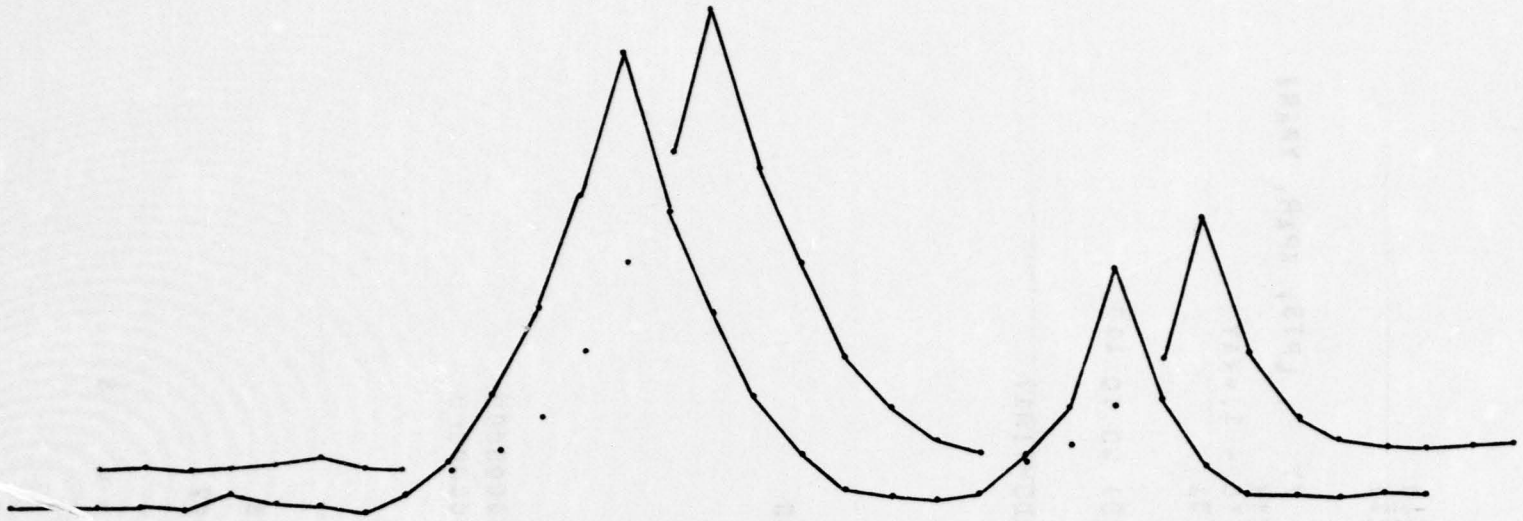
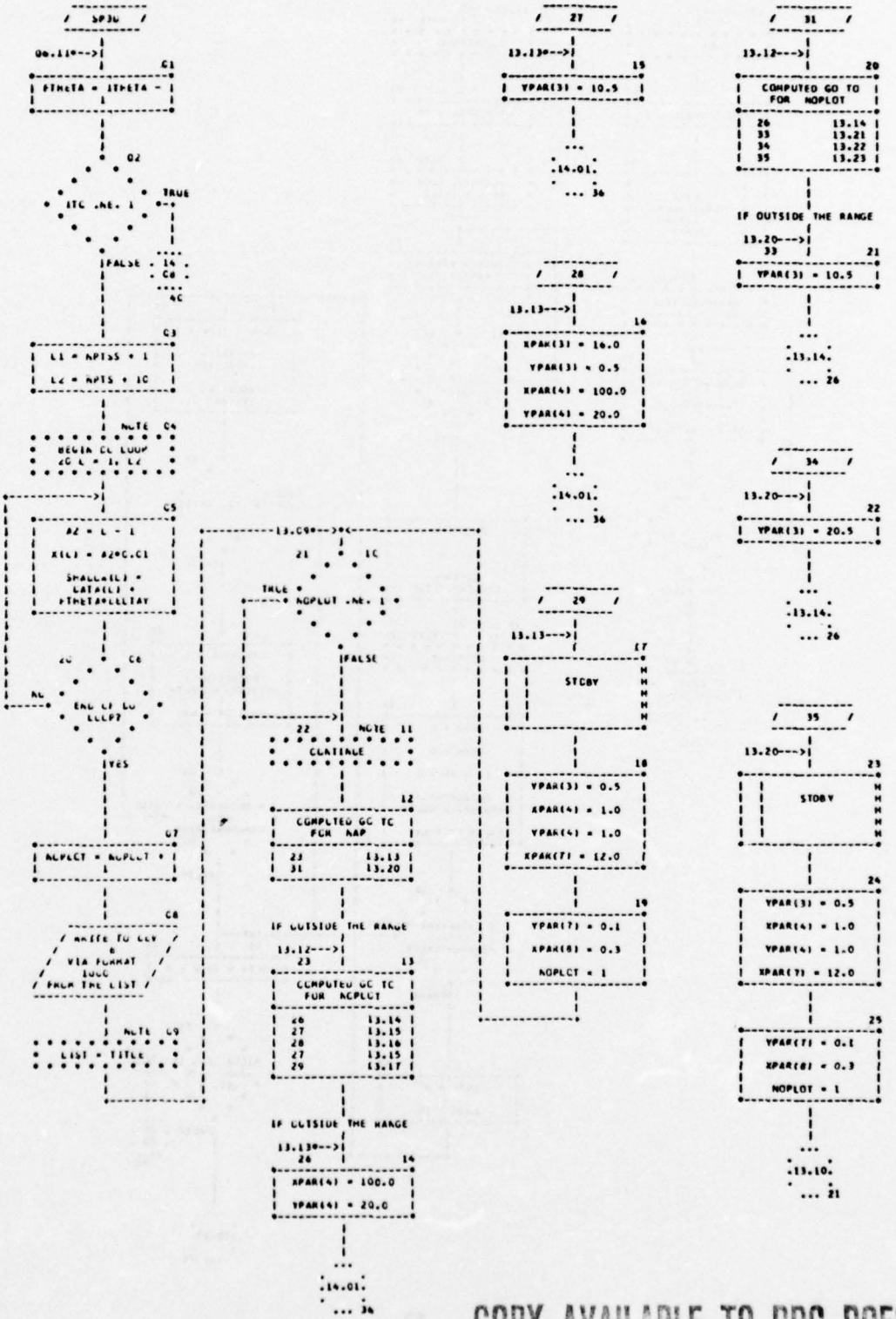


Figure 4 SP3D SHADOWING TECHNIQUE

CHART TITLE - SUBROUTINE SP30(ITHETA,SHADOW,XI



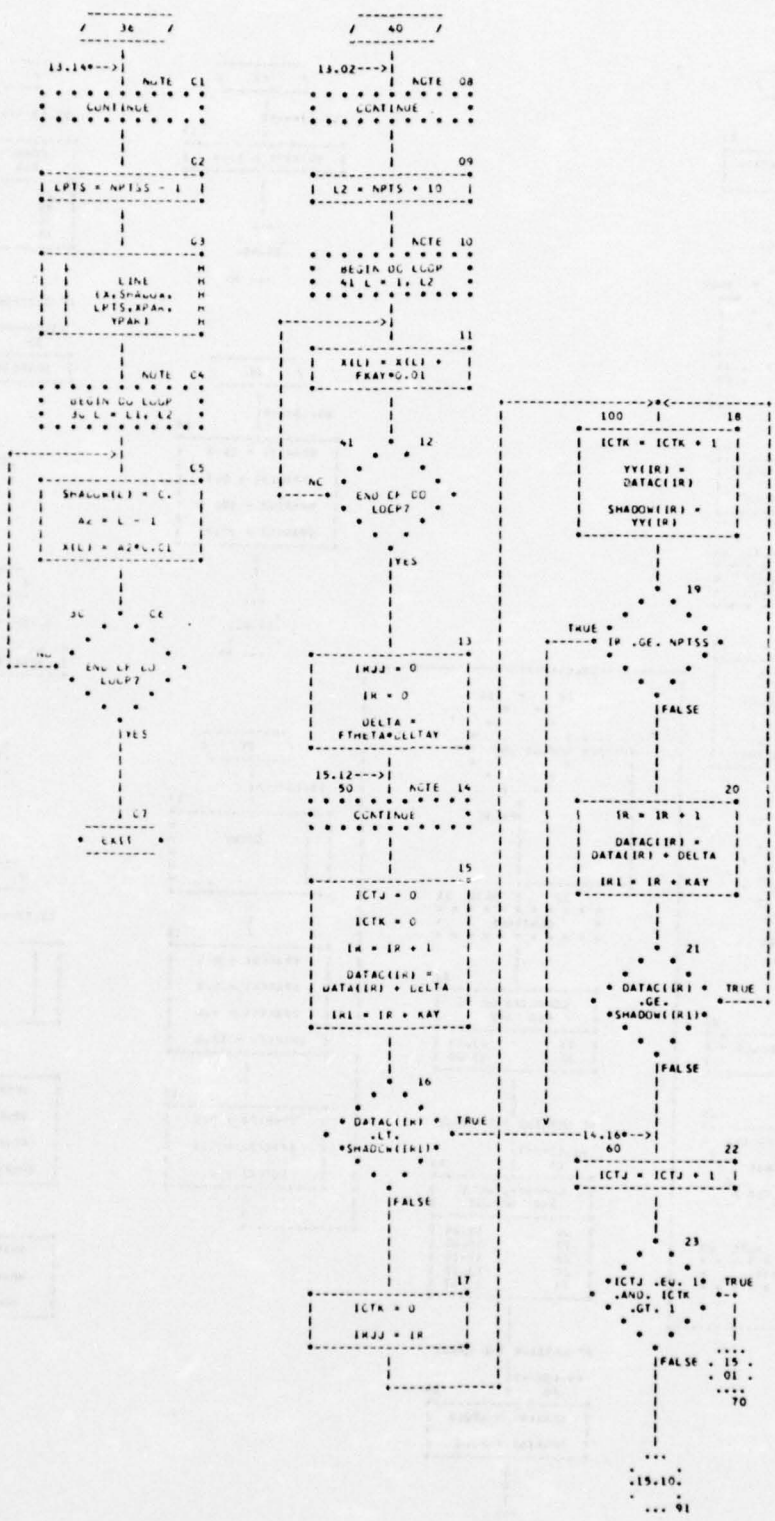
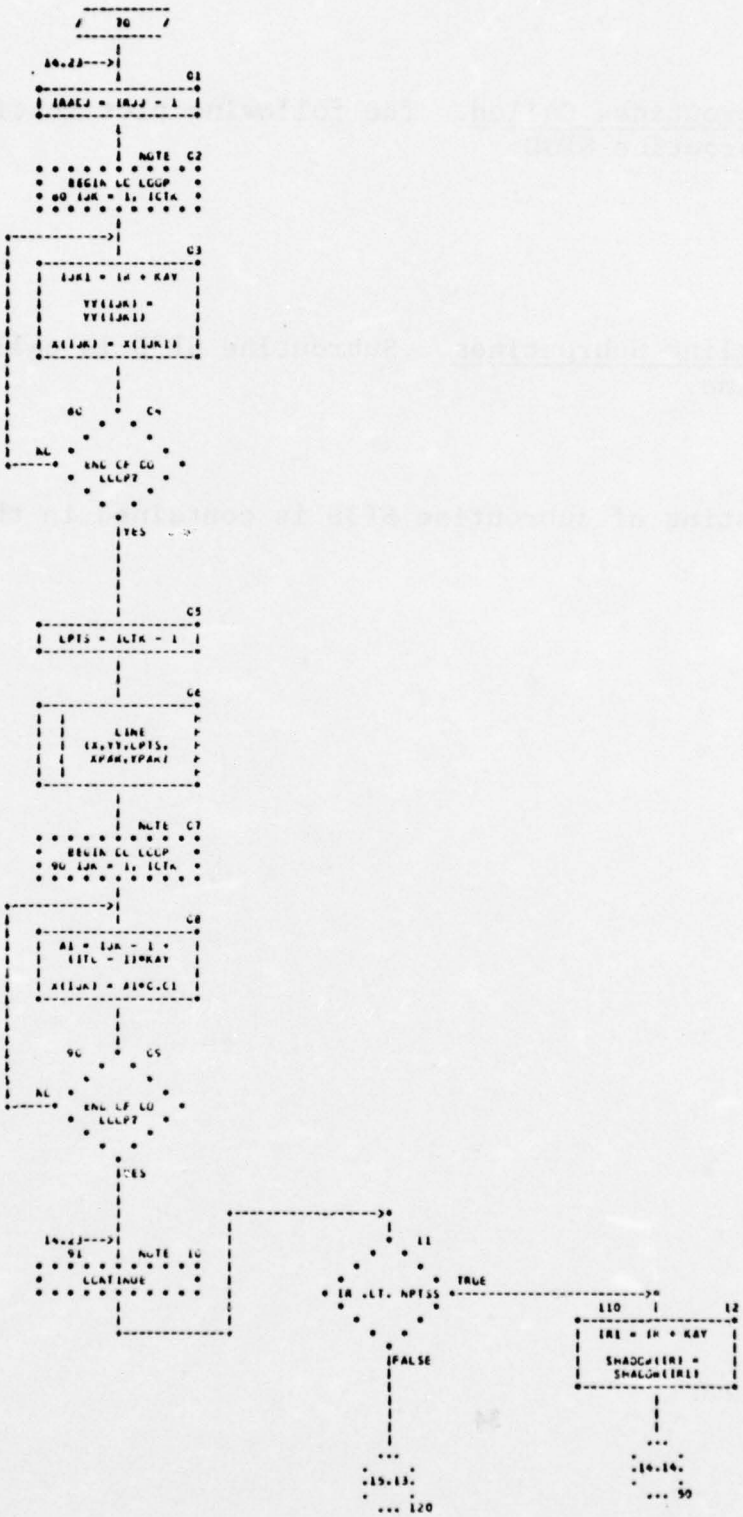


CHART TITLE - SUBROUTINE SPJCET(THETA,SHADOW,XI
36
13.149
NOTE C1
CONTINUE
C2
LPTS = NPTSS - 1
C3
LINE (XI,SHADOW, LPTS,XPAR, YPAR)
NOTE C4
BEGIN DO LOOP 36 L = L1, L2
C5
SHADOW(L) = 0.
AL = L - 1
XI(L) = AL*0.01
36
C6
NO
END OF DO LOOP?
YES
C7
CALL
40
13.02
NOTE 08
CONTINUE
09
L2 = NPTS + 10
NOTE 10
BEGIN DO LOOP 41 L = 1, L2
11
XI(L) = XI(L) + PKAY*0.01
41
12
NO
END OF DO LOOP?
YES
13
IHJJ = 0
IR = 0
DELTA = PTHETA*DELTAY
15.12
50
NOTE 14
CONTINUE
15
ICTJ = 0
ICTK = 0
IR = IR + 1
DATAC(IR) = DATAC(IR) + DELTA
IRL = IR + KAY
16
DATAC(IR) .LT. SHADOW(IRL)
TRUE
FALSE
17
ICTK = 0
IHJJ = IR
100
18
ICTK = ICTK + 1
YY(IR) = DATAC(IR)
SHADOW(IR) = YY(IR)
19
IR .GE. NPTSS
TRUE
FALSE
20
IR = IR + 1
DATAC(IR) = DATAC(IR) + DELTA
IRL = IR + KAY
21
DATAC(IR) .GE. SHADOW(IRL)
TRUE
FALSE
14,160
60
22
ICTJ = ICTJ + 1
23
ICTJ .EQ. 1 .AND. ICTK .GT. 1
TRUE
FALSE
15
01
70
15,10
91


70
80,23
C1
IRAEJ = IRJJ - 1
NOTE C2
BEGIN LC LOOP
DO IJK = 1, ICTA
C3
IJK1 = IH + KAY
YYE1JK1 =
YYE1JK1)
AE1JK1 = XE1JK1)
DO C4
END OF DO
LOOP
NO
YES
C5
LPTS = ICTA - 1
C6
LINE
(A,YY,LPTS,
APAR,YPAR)
NOTE C7
BEGIN LC LOOP
DO IJK = 1, ICTA
C8
AI = IJK - 1 +
EITC - IJORAY
AE1JK1 = AI*C.C1
90 C9
END OF DO
LOOP
YES
90,23
91 NOTE 10
CONTINUE
11
IR .LT. NPTSS
TRUE
FALSE
110 I 12
IR1 = IH + KAY
SHADO(EIR1 =
SHALO(EIR1)
15,13.
... 120
16,16.
... 90
120
15,11
13
EXIT

3.2.2.3.3 Subroutines Called. The following plot routines are called from subroutine SP3D:

1. STDBY

2. LINE

3.2.2.3.4 Calling Subroutines. Subroutine SP3D is called by the executive routine.

3.2.2.4 Listing

A complete listing of subroutine SP3D is contained in the following pages.

1-19-72 16.764

```
      SUBROUTINE SP3D( ITHETA   ,SHADOW   ,X    )
      COMMON/BLOCK1/NPTS,NPTSS,ITC,KAY,DELTAY,DATA(540)
      COMMON /BLOCK2/ XU, YL, YU, TITLE(11)
      COMMON /BLOCK3/ NOPLOT, FKAY, NAP
      COMMON /BLOCK4/ XPAR(8), YPAR(8)
C
      DIMENSION       X(600) ,    YY(600)    ,SHADOW(600)   ,DATAC(600)
C
      FTHETA = ITHETA - 1
      IF( ITC .NE. 1 ) GO TO 40
      L1 = NPTSS + 1
      L2 = NPTS  + 10
      DO 20 L = 1,L2
      A2 = L - 1
      X(L) = A2 * 0.01
      SHADOW(L) = DATA(L) + FTHETA * DELTAY
   20 CONTINUE
      NOPLOT = NOPLOT + 1
   21 IF (NOPLOT .NE. 1)  GO TO 22
      WRITE (6,1000)  TITLE
 1000 FORMAT (11A4)
   22 CONTINUE
      GO TO (23,31) , NAP
   23 GO TO (26,27,28, 27,29), NOPLOT
   26 XPAR(4) = 100.0
      YPAR(4) = 20.0
      GO TO 36
   27 YPAR(3) = 10.5
      GO TO 36
   28 XPAR(3) = 16.0
      YPAR(3) = 0.5
      XPAR(4) =100.0
      YPAR(4) =20.0
      GO TO 36
   29 CALL STDRY
      YPAR(3) = 0.5
      XPAR(4) = 1.0
      YPAR(4) = 1.0
      XPAR(7) = 12.0
      YPAR(7) = 0.1
      XPAR(8) = 0.3
      NOPLOT = 1
      GO TO 21
C
   31 GO TO (26,33,34,35), NOPLOT
   33 YPAR(3) = 10.5
      GO TO 26
   34 YPAR(3) = 20.5
      GO TO 26
   35 CALL STDRY
      YPAR(3) =  0.5
```

```
      XPAR(4) =  1.0
      YPAR(4) =  1.0
      XPAR(7) = 12.0
      YPAR(7) =  0.1
      XPAR(8) =  0.3
      NOPLOT = 1
      GO TO 21
C
C
   36 CONTINUE
      LPTS = NPTSS - 1
C
      CALL LINE ( X, SHADOW , LPTS, YPAR, YPAR)
      DO 30  L = L1, L2
      SHADOW(L) = 0.
      A2 = L - 1
      X(L) = A2 * 0.01
   30 CONTINUE
      RETURN
C
   40 CONTINUE
      L2 = NPTS + 10
      DO 41 L =  1, L2
      X(L) = X(L) + FKAY*0.01
   41 CONTINUE
      IRJJ = 0
      IR   = 0
      DELTA = FTHETA * DELTAY
   50 CONTINUE
      ICTJ = 0
      ICTK = 0
      IR = IR + 1
      DATAC(IR) = DATA(IR) + DELTA
      IR1 = IR + KAY
      IF ( DATAC(IR) .LT. SHADOW(IR1) )  GO TO 60
      ICTK = 0
      IRJJ = IR
  100 ICTK = ICTK + 1
      YY(IR) = DATAC(IR)
      SHADOW(IR) = YY(IR)
      IF( IR .GE. NPTSS) GO TO 60
      IR = IR + 1
      DATAC(IR) = DATA(IR) + DELTA
      IR1 = IR + KAY
      IF ( DATAC(IR) .GE. SHADOW(IR1) )  GO TO 100
   60 ICTJ = ICTJ + 1
      IF ( ICTJ .EQ. 1  .AND.  ICTK .GT. 1 )  GO TO 70
      GO TO 91
   70 IRADJ  = IRJJ - 1
      DO 80  IJK = 1, ICTK
      IJK1 = IR + KAY
      YY(IJK) = YY(IJK1)
```

```
L-19-72   16.764

      X (IJK) =  X(IJK1)
      CONTINUE
      LPTS = ICTK - 1
      CALL LINE ( X,   YY   , LPTS, XPAR, YPAR)
      DO 90 IJK = 1,ICTK
      A1 = IJK-1  + (ITC - 1)*KAY
      X(IJK) = A1 * 0.01
   90 CONTINUE
   91 CONTINUE
      IF( IR .LT. NPTSS) GO TO 110
      GO TO 120
  110 IR1 = IR + KAY
      SHADOW(IR) = SHADOW(IR1)
      GO TO 50
  120 RETURN
      END

WORDS OF MEMORY USED BY THIS COMPILATION
```

3.2.3 Computer Program Subroutine DATAIN

Subroutine DATAIN is written in GE Assembly Language for use with program SP3D.

3.2.3.1 Description of Subroutine DATAIN

The standard magnetic tape record length for General Dynamics radar range data is 1852 BCD characters. This record length exceeds the allowable length for a FORTRAN read in GE FORTRAN IV language. DATAIN was written to allow data with this record length to be read from magnetic tape and stored in the array INDAT.

3.2.3.2 Interfaces

3.2.3.2.1 Input. Input to DATAIN consists of data contained on magnetic tape.

3.2.3.2.2 Output. Data read from magnetic tape are placed in the array INDAT.

3.2.3.3 Listing

A listing of DATAIN may be found in the following pages.

```
$       IDENT   BECAVJ01,HANCOCK ,651211040063,TAPEIN
$       GMAP    LSTOU,STAB,DECK,SYMTAB
$       LIMITS  05,20K,0,5K
$       RMFL    C*,W,L,BECAVU017OTAPIN
        SYMDEF  DATAIN
        BLOCK                           BLANK COMMON
INDAT   BSS     309                     BUFFER AREA
IPEF    BSS     1                       CHAR/WORD XMITTAL STATUS
STATW.  BSS     2                       STATUS RETURN WORD
IERR    BSS     1                       ERROR RETURN TO CALLING PROGRAM
        USE     PREVIOUS
DATAIN  SAVE                            ENTRY POINT
        LDA     DCW1
        STA     DCW
        LDA     =-2
        STA     STATR
        MME     GEINOS
        RTD
        ZERO    FA,DCW                  FILE CODE WORD, DATA CONTROL WORD
        ZERO    STATR                   STATUS RETURN WORD
        MME     GEROAB
        LDAQ    STATR
        STAQ    STATW
        ANA     =0070000,DU
        TZE     ERRF                    NO ERRORS DETECTED BY TAPE CONTR
        CMPA    =0040000,DU
        TZE     EOF                     END OF FILE DETECTED
        CMPA    =0030000,DU
        TZE     DALRT                   DATA ALERT DETECTED
        LDA     =4,DL
        TRA     ERRF                    UNKNOWN ERROR DETECTED
EOF     LDA     =1,DL                   END OF FILE
EXIT    STA     IERR
        TRA     RTURN
DALRT   LDA     STATR                   DATA ALERT
        ANA     =0007700,DU
        CMPA    =0000200,DU             TEST FOR BLANK TAPE ON READ
        TNZ     PCK
        LDA     =16,DL
        TRA     EXIT
PCK     ANA     =0001000,DU
        TNZ     LATPC
        LDA     =2,DL                   LONGITUDINAL PARITY CHECK
        TRA     ERRF
LATPC   LDA     =3,DL                   LATERAL PARITY CHECK
ERRF    STA     IERR
        ANQ     =0707777,DL             TEST RECORD LENGTH READ
        STQ     IPEF                    CHAR/WORD REMAINING TO XFER
        TZE     TEST3
        LLS     21                      A=NUMBER OF CHAR IN LAST WORD
        QRS     21                      Q=NUMBER OF WORDS NOT XMITTED
        CMPQ    =1,DL
```

```
        TZE     SREC            Q=1;ZERO=1
        TNC     CARCK           Q<1;CARRY=0
        LDQ     =20,DL          SHORT REC- MORE THAN 1 WORD DEFECTIVE
        TRA     ENDE
CARCK   CMPA    =2,DL
        LDA     IERR
        TNC     SREC            A<2;CARRY=0
TEST3   CMPA    =3,DL
        TNZ     CHTL            A NOT= 3;ZERO=0
        LDA     =0,DL
        STA     IERR
        TRA     CHTL
SREC    LDQ     =10,DL          SHORT RECORD-LAST WORD DEFECTIVE
ENDE    ASQ     IERR            COMBINE REC. LENG. TEST WITH IOC STAT.
CHTL    LDX0    =0,DU           CHARACTER TRANSLATE  + AND = SIGNS
NWORD   CMPX0   =309,DU         BEGINNING OF WORD LOOP
        TZE     RTURN
        LDA     INDAT,0         X0 IS INDEX REGISTER
        LDX1    =6,DU
        LDQ     =077777777700
TESTC   NOP                     BEGINNING OF CHAR. LOOP
        CMK     =013,DL         TEST RIGHT MOST CHAR FOR =
        TZE     EQUAL
        CMK     =032,DL         TEST RIGHT MOST CHAR FOR +
        TZE     PLUS
ROTAT   ALR     6
        SBX1    =1,DU
        TNZ     TESTC           END OF CHAR. LOOP
        STA     INDAT,0
        ADX0    =1,DU
        TRA     NWORD           END OF WORD LOOP
EQUAL   ERA     =0000066,DL     CORRECT = SIGN
        TRA     ROTAT
PLUS    ERA     =0000052,DL     CORRECT + SIGN
        TRA     ROTAT
RTURN   RETURN  DATAIN          RETURN TO CALLING PROGRAM
FA      BCI     1,000013
STATR   BSS     2
DCW1    IOTD    INDAT,309       BUFFER ARRAY, NUMBER OF WORDS XMITTED
DCW     BSS     1
        END
$       ENDJOB
```

SECTION 4

TEST DESCRIPTION

A test problem was run on the GE 635/645 computer for the purposes of debugging computer program DISCRM. A description of the test problem is presented in the following paragraphs.

4.1 INPUT DATA

A listing of the values of the variables read from card input is found below. The format of the card input data and the definition of the variables may be found in Section 3.2.1.3.

CARD 1

VARIABLE	VALUE
NFILES	3
NFSKP	1
NRPS	6
NSWPLT	70
NAP	0
KAY	6
YTOP	0.0

CARD 2

VARIABLE	VALUE
IFSKP(1)	1

CARD 3

VARIABLE	VALUE
TITLE	SP3D Test Tape

A test tape was generated for the purpose of debugging this program. The tape format is described in Section 3.1.4. The tape contains 3 files; two of which contain data. It is standard practice to place an end-of-file mark on magnetic tapes produced on the radar range at the Fort Worth Operation, therefore, this end-of-file mark must always be skipped to reach the data files.

4.2 OUTPUT DATA

The output for the sample problem may be found in the following pages. After bypassing the end-of-file mark, the header and trailer information of the first record of each sweep is printed as it is read. A second listing identical to the first but produces as the data are being plotted follows the first listing. A plot of the data produces on the RADC plotter is not available due to plotter problems, however, a plot of the second data file as produced at General Dynamics is provided.

```
NFILES =    3 NFSKP  =   1
NRPS   =    6 ISWPLT =  70
KAY    =    6
FILES TO BE SKIPPED
     1

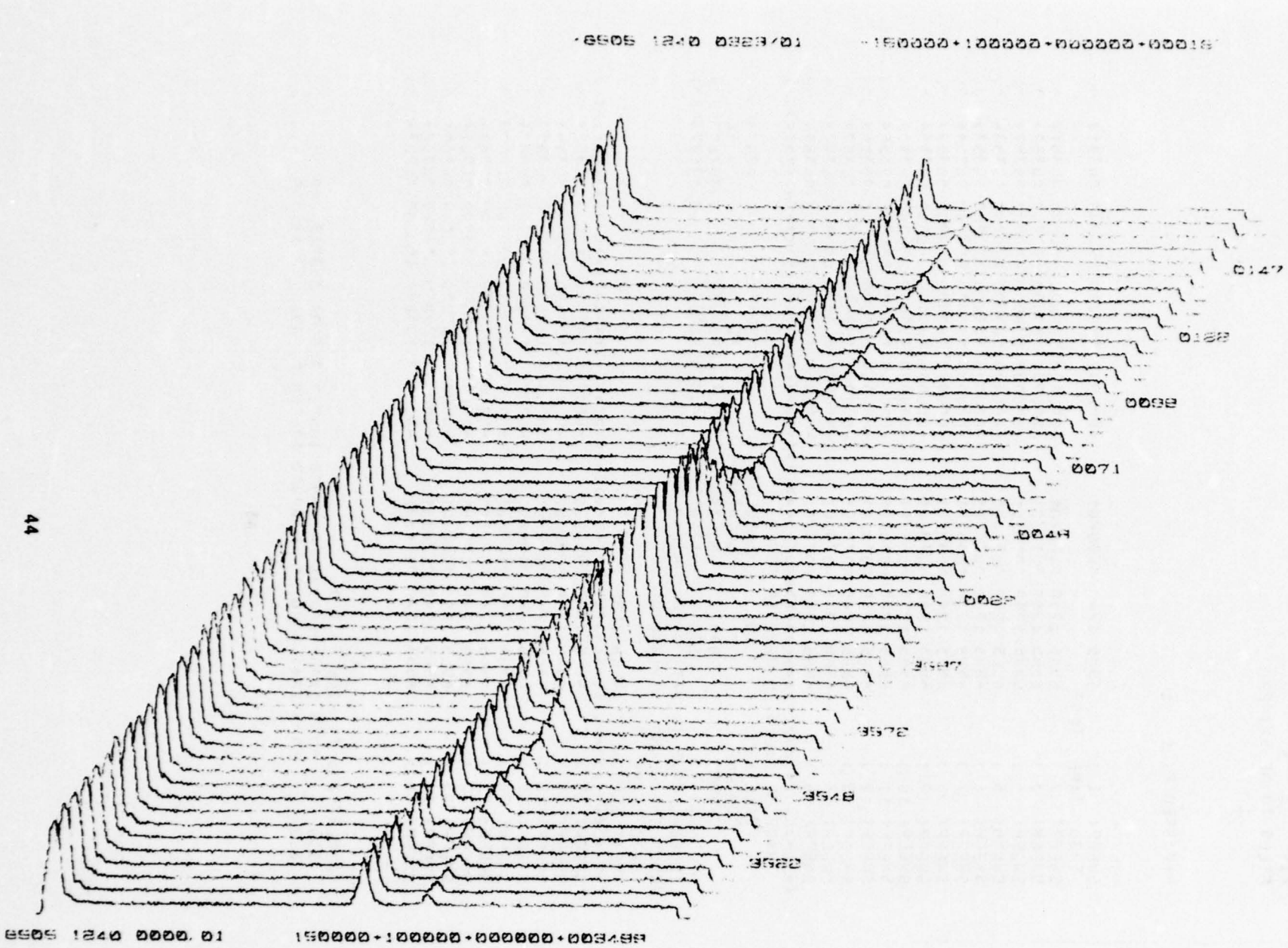


BYPASSED FILE   1


SWEEP(  1 )       6505 1240 0000/01      -000000 100000 000000 003513   00
 SP3D  TAPE  TEST
SWEEP(  2 )       6505 1240 0006/01      -000000 100000 000000 003519   00
SWEEP(  3 )       6505 1240 0012/01      -000000 100000 000000 003524   00
SWEEP(  4 )       6505 1240 0018/01      -000000 100000 000000 003529   00
SWEEP(  5 )       6505 1240 0024/01      -000000 100000 000000 003534   00
SWEEP(  6 )       6505 1240 0030/01      -000000 100000 000000 003539   00
SWEEP(  7 )       6505 1240 0036/01      -000000 100000 000000 003544   00
SWEEP(  8 )       6505 1240 0042/01      -000000 100000 000000 003549   00
SWEEP(  9 )       6505 1240 0048/01      -000000 100000 000000 003554   00
SWEEP( 10 )       6505 1240 0054/01      -000000 100000 000000 003560   00
SWEEP( 11 )       6505 1240 0060/01      -000000 100000 000000 003564   00
SWEEP( 12 )       6505 1240 0066/01      -000000 100000 000000 003569   00
SWEEP( 13 )       6505 1240 0072/01      -000000 100000 000000 003574   00
SWEEP( 14 )       6505 1240 0078/01      -000000 100000 000000 003579   00
SWEEP( 15 )       6505 1240 0084/01      -000000 100000 000000 003584   00
<*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*>
 TRACE OF CALLS IN REVERSE ORDER
    CALLING           ID         ABSOLUTE          ARGUMENT              ARGUMENT
    ROUTINE           #          LOCATION             #1                    #2
    ,FRDD.           830         035740         004062000040          053376776004
    .......          150         176675         000000000000          350767730331
ILLEGAL CHAR IN DATA BELOW OR BAD FORMAT
ERROR IN COLUMN   121036 OF
 SP3D  TAPE  TEST
TREAT ILLEGAL CHAR AS ZERO
<*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*>
SWEEP( 16 )       6505 1240 0090/01      -000000 100000 000000 003589   00
SWEEP( 17 )       6505 1240 0096/01      -000000 100000 000000 003593   00
SWEEP( 18 )       6505 1240 0102/01      -000000 100000 000000 003599   00
SWEEP( 19 )       6505 1240 0108/01      -000000 100000 000000 000004   00
SWEEP( 20 )       6505 1240 0114/01      -000000 100000 000000 000009   00
SWEEP( 21 )       6505 1240 0120/01      -000000 100000 000000 000014   00
SWEEP( 22 )       6505 1240 0126/01      -000000 100000 000000 000019   00
SWEEP( 23 )       6505 1240 0132/01      -000000 100000 000000 000024   00
SWEEP( 24 )       6505 1240 0138/01      -000000 100000 000000 000029   00
SWEEP( 25 )       6505 1240 0144/01      -000000 100000 000000 000034   00



COMPLETED DATA FILE (   2 )
  1.0        6505 1240 0000/01   -000000 100000 000000 003513   00
  2.0        6505 1240 0006/01   -000000 100000 000000 003519   00
```


0071
0548
0572
0548
0548
0548

```
   3.0        6505 1240 0012/01   -000000 100000 000000 003524   00
   4.0        6505 1240 0018/01   -000000 100000 000000 003529   00
   5.0        6505 1240 0024/01   -000000 100000 000000 003534   00
   6.0        6505 1240 0030/01   -000000 100000 000000 003539   00
   7.0        6505 1240 0036/01   -000000 100000 000000 003544   00
   8.0        6505 1240 0042/01   -000000 100000 000000 003549   00
   9.0        6505 1240 0048/01   -000000 100000 000000 003554   00
  10.0        6505 1240 0054/01   -000000 100000 000000 003560   00
  11.0        6505 1240 0060/01   -000000 100000 000000 003564   00
  12.0        6505 1240 0066/01   -000000 100000 000000 003569   00
  13.0        6505 1240 0072/01   -000000 100000 000000 003574   00
  14.0        6505 1240 0078/01   -000000 100000 000000 003579   00
  15.0        6505 1240 0084/01   -000000 100000 000000 003584   00
  16.0        6505 1240 0090/01   -000000 100000 000000 003589   00
  17.0        6505 1240 0096/01   -000000 100000 000000 003593   00
  18.0        6505 1240 0102/01   -000000 100000 000000 003599   00
  19.0        6505 1240 0108/01   -000000 100000 000000 000004   00
  20.0        6505 1240 0114/01   -000000 100000 000000 000009   00
  21.0        6505 1240 0120/01   -000000 100000 000000 000014   00
  22.0        6505 1240 0126/01   -000000 100000 000000 000019   00
  23.0        6505 1240 0132/01   -000000 100000 000000 000024   00
  24.0        6505 1240 0138/01   -000000 100000 000000 000029   00
  25.0        6505 1240 0144/01   -000000 100000 000000 000034   00


 SWEEP(  1 )        6505 1240 0000/01       -150000 100000 000000 003489   00
 SWEEP(  2 )        6505 1240 0006/01       -150000 100000 000000 003494   00
 SWEEP(  3 )        6505 1240 0012/01       -150000 100000 000000 003499   00
 SWEEP(  4 )        6505 1240 0018/01       -150000 100000 000000 003504   00
 SWEEP(  5 )        6505 1240 0024/01       -150000 100000 000000 003509   00
 SWEEP(  6 )        6505 1240 0030/01       -150000 100000 000000 003513   00
<*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*>
  TRACE OF CALLS IN REVERSE ORDER
      CALLING          ID        ABSOLUTE          ARGUMENT              ARGUMENT
      ROUTINE          #         LOCATION             #1                    #2
      ,FRDD.          830        035740        004062000040          153426776400
      ......          153        176717        000000000000          351167730331
 ILLEGAL CHAR IN DATA BELOW OR BAD FORMAT
ERROR IN COLUMN    121176 OF
  SP3D  TAPE  TEST
 TREAT ILLEGAL CHAR AS ZERO
<*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*><*>
 SWEEP(  7 )        6505 1240 0036/01       -150000 100000 000000 003519   00
 SWEEP(  8 )        6505 1240 0042/01       -150000 100000 000000 003524   00
 SWEEP(  9 )        6505 1240 0048/01       -150000 100000 000000 003529   00
 SWEEP( 10 )        6505 1240 0054/01       -150000 100000 000000 003534   00
 SWEEP( 11 )        6505 1240 0060/01       -150000 100000 000000 003539   00
 SWEEP( 12 )        6505 1240 0066/01       -150000 100000 000000 003545   00
 SWEEP( 13 )        6505 1240 0072/01       -150000 100000 000000 003549   00
 SWEEP( 14 )        6505 1240 0078/01       -150000 100000 000000 003554   00
 SWEEP( 15 )        6505 1240 0084/01       -150000 100000 000000 003559   00
 SWEEP( 16 )        6505 1240 0090/01       -150000 100000 000000 003564   00
 SWEEP( 17 )        6505 1240 0096/01       -150000 100000 000000 003569   00
 SWEEP( 18 )        6505 1240 0102/01       -150000 100000 000000 003575   00
 SWEEP( 19 )        6505 1240 0108/01       -150000 100000 000000 003579   00
 SWEEP( 20 )        6505 1240 0114/01       -150000 100000 000000 003585   00
 SWEEP( 21 )        6505 1240 0120/01       -150000 100000 000000 003589   00
 SWEEP( 22 )        6505 1240 0126/01       -150000 100000 000000 003594   00
 SWEEP( 23 )        6505 1240 0132/01       -150000 100000 000000 003599   00
 SWEEP( 24 )        6505 1240 0138/01       -150000 100000 000000 000004   00
```

SWEEP(25) 6505 1240 0144/01 -150000 100000 000000 000000

COMPLETED DATA FILE (3)

1.0	6505	1240	0900/01	-150000	100000	000000	003459
2.0	6505	1240	0906/01	-150000	100000	000000	003494
3.0	6505	1240	0912/01	-150000	100000	000000	003499
4.0	6505	1240	0918/01	-150000	100000	000000	003504
5.0	6505	1240	0924/01	-150000	100000	000000	003509
6.0	6505	1240	0930/01	-150000	100000	000000	003513
7.0	6505	1240	0936/01	-150000	100000	000000	003519
8.0	6505	1240	0942/01	-150000	100000	000000	003524
9.0	6505	1240	0948/01	-150000	100000	000000	003529
10.0	6505	1240	0954/01	-150000	100000	000000	003534
11.0	6505	1240	0960/01	-150000	100000	000000	003539
12.0	6505	1240	0966/01	-150000	100000	000000	003545
13.0	6505	1240	0972/01	-150000	100000	000000	003549
14.0	6505	1240	0978/01	-150000	100000	000000	003554
15.0	6505	1240	0984/01	-150000	100000	000000	003559
16.0	6505	1240	0990/01	-150000	100000	000000	003564
17.0	6505	1240	0996/01	-150000	100000	000000	003569
18.0	6505	1240	1002/01	-150000	100000	000000	003575
19.0	6505	1240	1008/01	-150000	100000	000000	003579
20.0	6505	1240	1014/01	-150000	100000	000000	003583
21.0	6505	1240	1020/01	-150000	100000	000000	003589
22.0	6505	1240	1026/01	-150000	100000	000000	003594
23.0	6505	1240	1032/01	-150000	100000	000000	003599
24.0	6505	1240	1038/01	-150000	100000	000000	000004
25.0	6505	1240	1044/01	-150000	100000	000000	000009

SECTION III

DISCRM

COMPUTER PROGRAM DOCUMENTATION

TABLE OF CONTENTS

S E C T I O N 1

S C O P E

This specification establishes the requirements for complete identification and acceptance of the computer program to be formally accepted by the procuring agency. EDP program DISCRM was originally written by the Convair Aerospace Division of General Dynamics for use with an IBM 360 computer system under Contract F30602-69-C-0164; however, the necessary changes have been incorporated to make the program compatible with the GE 634/645 computer system at RADC. This documentation has been prepared in accordance with RADC Computer Program Detail Specification, 28 January 1968.

SECTION 2

APPLICABLE DOCUMENTS

The documents of exact issue shown, form a part of this specification to the extent specified herein. In the event of conflict between documents referenced here and the contents of Sections 3, 4 and 5, the detailed contents of Sections 3 through 5 shall be considered as superceding requirements.

GE-600 Line FORTRAN IV	CPB-1006G
GE-600 Line FORTRAN IV Subroutine Libraries	CPB-1620
GE-600 Line General Loader	CPB-1008F
GE-600 Line System Editor	CPB-1138C

SECTION 3

REQUIREMENTS

Computer program DISCRM was developed for the purpose of extracting discriminant data from Equivalence Class data made available from computer program SPECT. The Equivalence Class Method of compactly and efficiently storing radar signature data is described in "Radar Signature Investigation Vol. II - Target Classification", RADC-TR-70-257.

3.1 CP CHARACTERISTICS

Computer program DISCRM extracts three primary discriminants from the Equivalence Class data. These include (1) Equivalence Class Category, i.e., number of significant peaks in a signature, (2) maximum target radar cross section in the signature and (3) maximum separation between significant peaks in the signature. These discriminants represent a measure of target complexity, target size and target length respectively. Computer program DISCRM, which consists of an executive routine and subroutine OUTPUT, is described in detail in the following paragraphs.

3.1.1 CP Flow Chart

Figure 1 depicts the overall flow of the CP.

3.1.2 CP Timing and Sequencing

Run time for the sample problem was approximately 0.78 minutes.

3.1.3 Storage Allocation

26K words of memory were required to load DISCRM.

3.1.4 Data Base Characteristics

Card input data containing equivalence class information is card output of computer program SPECT.

3.2 DISCRM SUBROUTINE CHARACTERISTICS

This paragraph contains the technical description of the computer program subroutines identified in paragraph

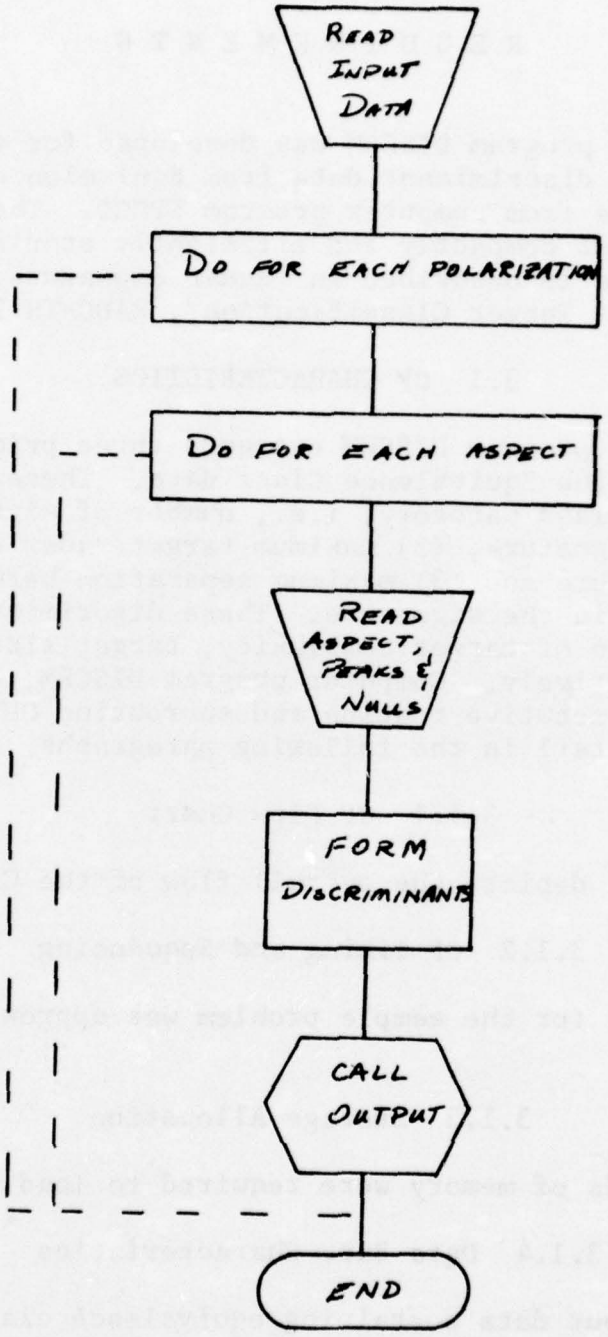


FIGURE 1 OVERALL VIEW OF DISCRM

3.1 of this specification. The instruction listings contained herein by inclusion or reference specify the exact configuration of DISCRM. DISCRM is written in FORTRAN IV language for use with the GE 635/645 computer system.

3.2.1 Executive Routine

The executive routine of DISCRM is responsible for (1) reading and testing card input data, (2) forming the discriminant data and (3) transferring output data to subroutine OUTPUT.

3.2.1.1 Description of Executive Routine

The user of DISCRM has the ability, through card input data, to (1) select the target region from which discriminants are formed and (2) to select the dynamic range of the discriminants. The value obtained by subtracting the variable DBDOWN (expressed in dB) from the maximum peak in a radar signature expresses the lower bound below which peaks are not to be considered. The variables RLOW and RHIGH express the minimum and maximum range respectively that is to be considered in obtaining the discriminants from a signature. RLOW and RHIGH are expressed in inches relative to the position of the 0dB radar cross section reference. These variables are illustrated in Figure 2.

The discriminants extracted from the target signature data are (1) EQCL; the number of significant peaks in a signature, (2) SIGMAX; the maximum target radar cross section in the signature and (3) DLRMAX; the maximum separation between peaks in the signature. The procedure by which these discriminants are formed is shown in Figure 2. These discriminants are formed for every polarization of interest.

3.2.1.2 Flow Chart

A flow chart of the executive routine is found in the following pages.

3.2.1.3 Interfaces

3.2.1.3.1 Input Data. Input data is entered via punched cards described in the following paragraphs.

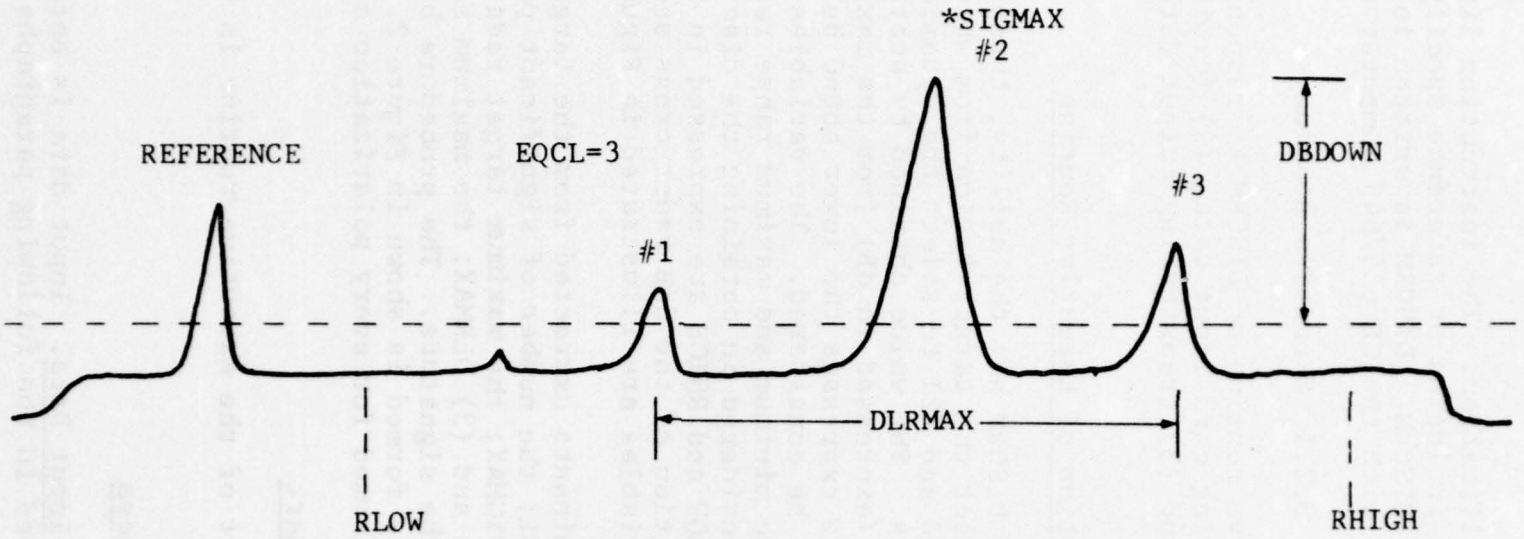
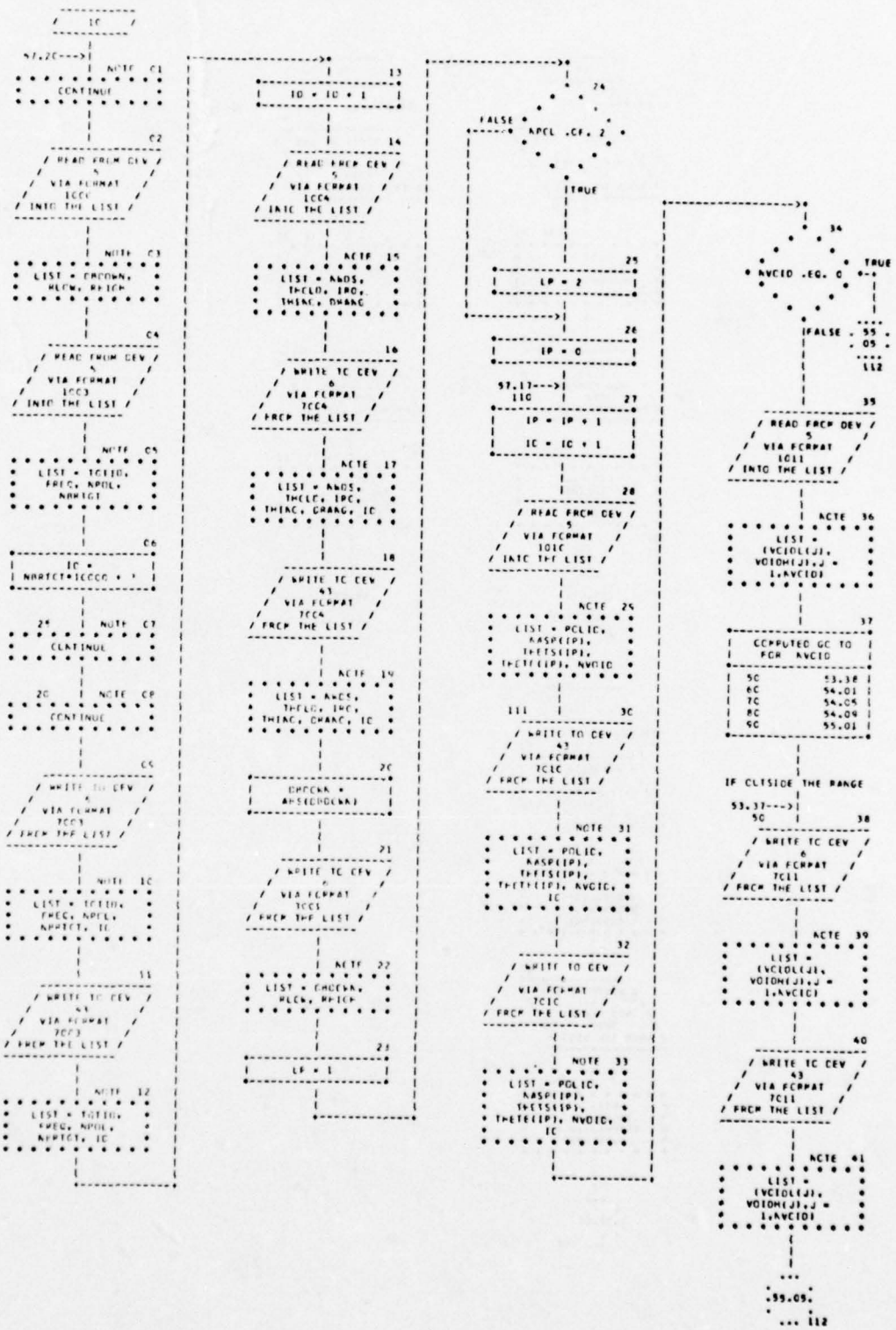
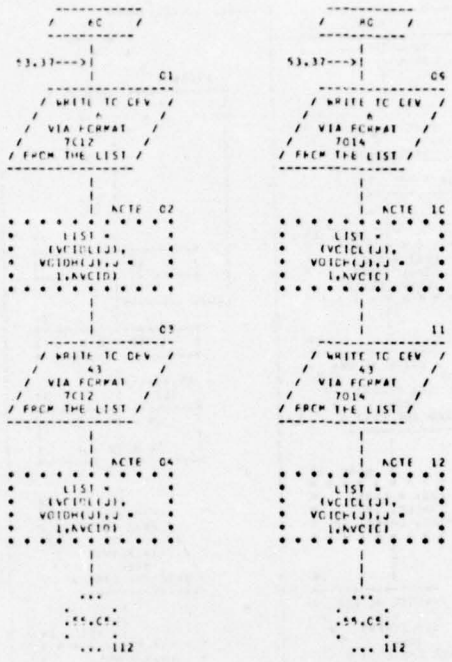
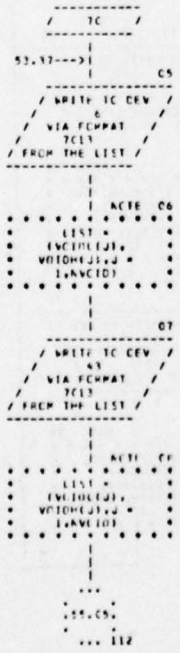
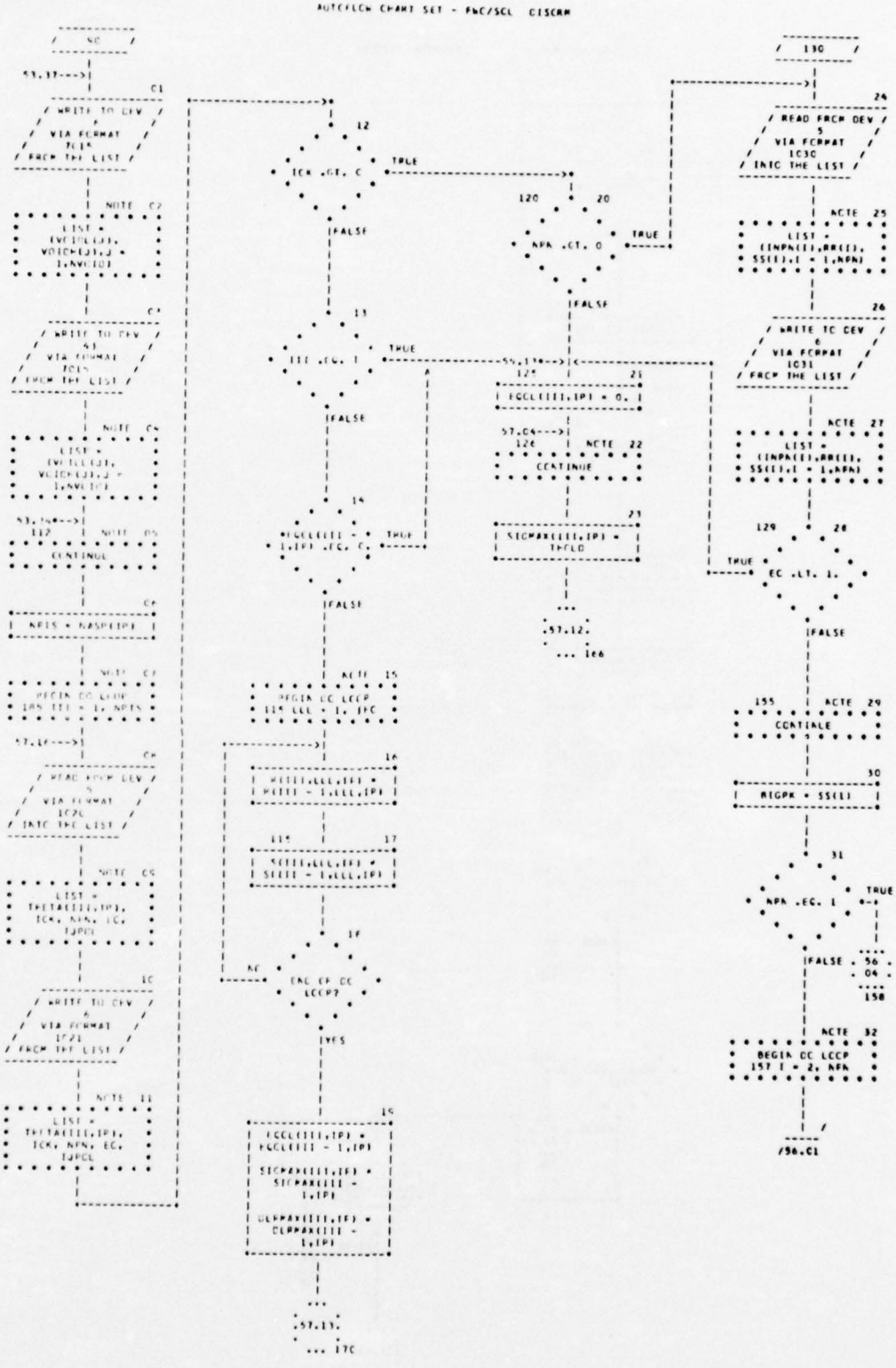


FIGURE 2 DISCRIMINANT FORMATION

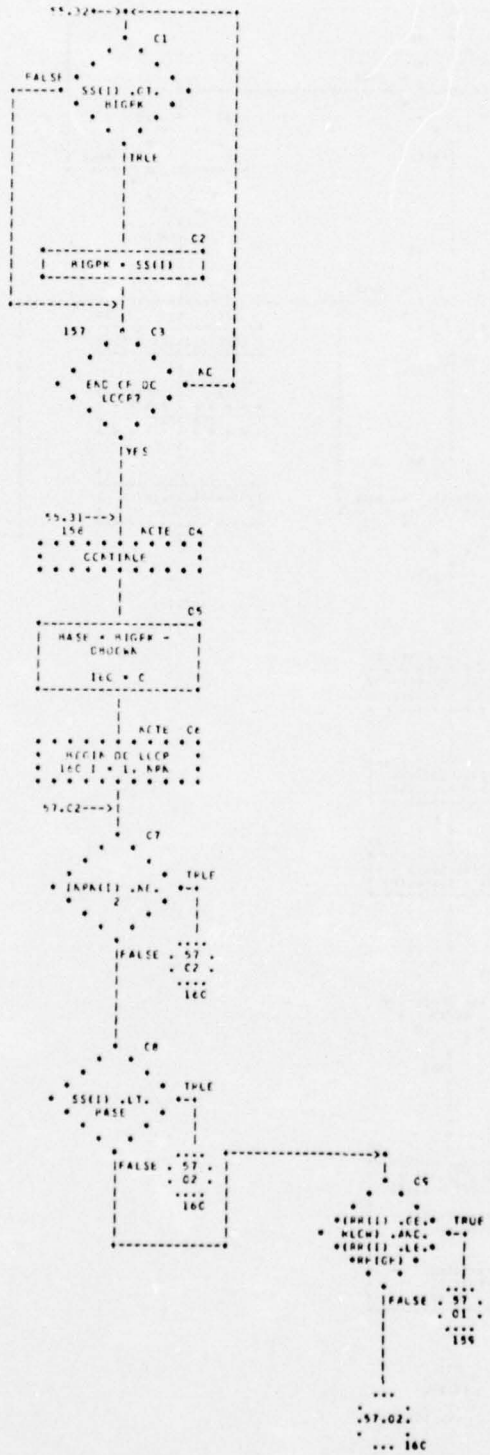

AUTOFLOW CHART SET - FNC/SCL DESCRM
IC
57,2C--->
NOTE C1
CONTINUE
C2
READ FRCM DEV 5
VIA FORMAT 1CC1
INTO THE LIST
NOTE C3
LIST = CHCONN, HLCN, RFICH
C4
READ FRCM DEV 5
VIA FORMAT 1CC3
INTO THE LIST
NOTE C5
LIST = TCEID, FREQ, NPOL, NPRTGT
C6
IC = NPRTCT*1CCCC + 1
2*
NOTE C7
CONTINUE
2C
NOTE CE
CONTINUE
C9
WRITE TC DEV 6
VIA FORMAT 7CC1
FRCM THE LIST
NOTE 1C
LIST = TCEID, FREQ, NPOL, NPRTCT, IC
11
WRITE TC DEV 43
VIA FORMAT 7CC3
FRCM THE LIST
NOTE 12
LIST = TCEID, FREQ, NPOL, NPRTCT, IC
13
ID = ID + 1
14
READ FRCM DEV 5
VIA FORMAT 1CC4
INTC THE LIST
ACTE 15
LIST = NNDS, THCLD, IRC, THIAC, DHANG
16
WRITE TC DEV 6
VIA FORMAT 7CC4
FRCM THE LIST
ACTE 17
LIST = NNDS, THCLC, IPC, THIAC, DHANG, IC
18
WRITE TC DEV 43
VIA FORMAT 7CC4
FRCM THE LIST
ACTE 19
LIST = NNCS, THCLC, IPC, THIAC, DHANC, IC
2C
DHCCNA = AHSECDCNA)
21
WRITE TC DEV 6
VIA FORMAT 7CC5
FRCM THE LIST
ACTE 22
LIST = CHCCNA, HLCN, RFICH
23
LP = 1
24
FALSE
APCL .CF. 2
TRUE
25
LP = 2
26
IP = 0
57,17--->
11C
27
IP = IP + 1
IC = IC + 1
28
READ FRCM DEV 5
VIA FORMAT 101C
INTC THE LIST
ACTE 29
LIST = PCLIC, NASPE(IP), THETSS(IP), THETE(IP), NVOIC
111
3C
WRITE TO DEV 43
VIA FORMAT 7C1C
FRCM THE LIST
NOTE 31
LIST = PCLIC, NASPE(IP), THETSS(IP), THETE(IP), NVOIC, IC
32
WRITE TO DEV 6
VIA FORMAT 7C1C
FRCM THE LIST
NOTE 33
LIST = PCLIC, NASPE(IP), THETSS(IP), THETE(IP), NVOIC, IC
34
NVCID .EQ. 0
TRUE
FALSE . 55 . . 05 .
112
35
READ FRCM DEV 5
VIA FORMAT 1C11
INTO THE LIST
ACTE 36
LIST = EVCIDLE(J), VOIDME(J),J = 1,NVCID
37
COMPUTED GC TO FCR NVCID
5C 53.38
6C 54.01
7C 54.05
8C 54.09
9C 55.01
IF OUTSIDE THE RANGE
53.37--->
5C
38
WRITE TC DEV 6
VIA FORMAT 7C11
FRCM THE LIST
ACTE 39
LIST = EVCIDLE(J), VOIDME(J),J = 1,NVCID
40
WRITE TC DEV 43
VIA FORMAT 7C11
FRCM THE LIST
ACTE 41
LIST = EVCIDLE(J), VOIDME(J),J = 1,NVCID
...
.55.05.
... 112


AC
53,37
C1
WRITE TC CRV
VIA FORMAT
7C12
FROM THE LIST
NCTE C2
LIST
(VCICL(J),
VOICH(J),J =
1,NVCIC)
C3
WRITE TC CRV
43
VIA FORMAT
7C12
FROM THE LIST
NCTE C4
LIST
(VCICL(J),
VOICH(J),J =
1,NVCIC)
,55,C4,
112
AC
53,37
C9
WRITE TC CRV
8
VIA FORMAT
7014
FROM THE LIST
NCTE 10
LIST
(VCICL(J),
VOICH(J),J =
1,NVCIC)
11
WRITE TC CRV
43
VIA FORMAT
7014
FROM THE LIST
NCTE 12
LIST
(VCICL(J),
VOICH(J),J =
1,NVCIC)
,55,C5,
112

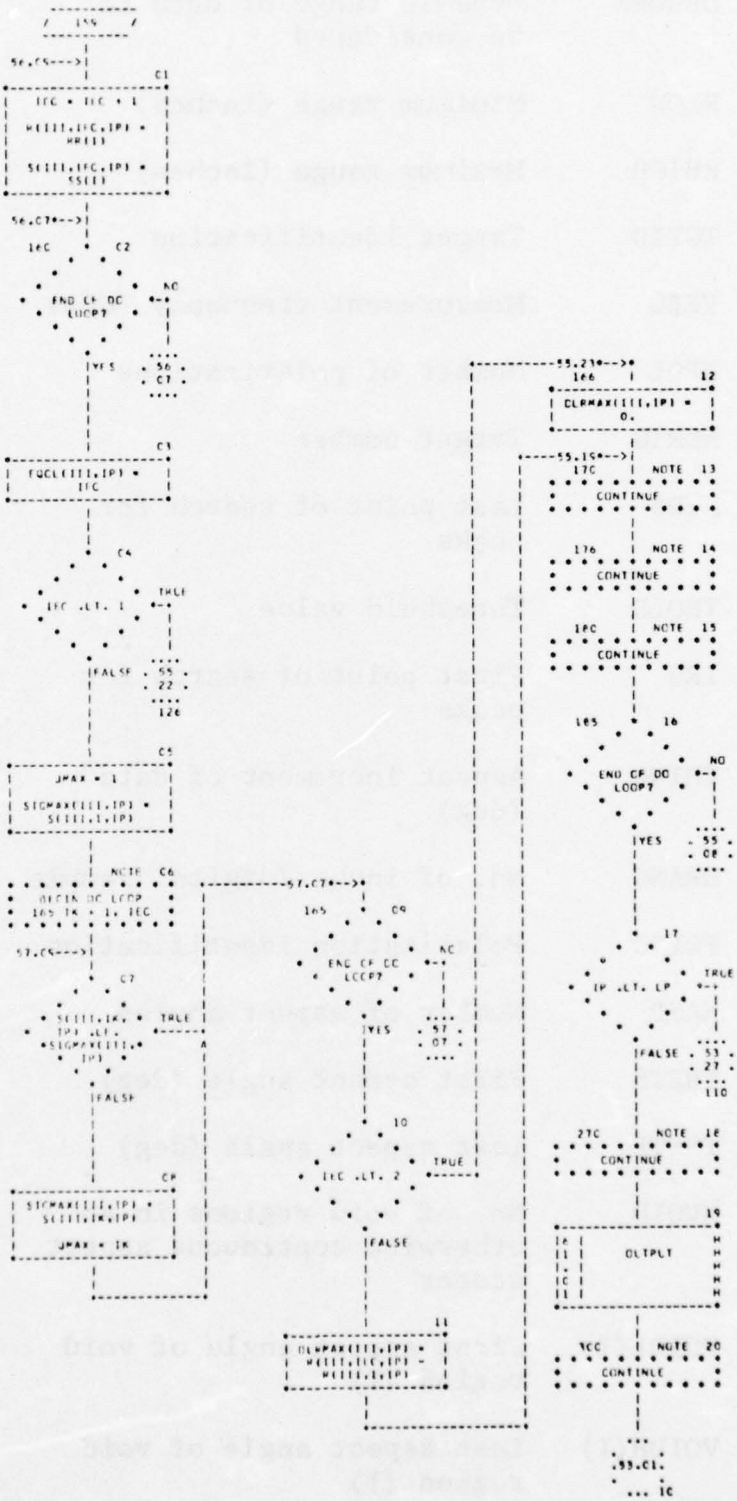

TC
53,37
C5
WRITE TC CRV
6
VIA FORMAT
7C13
FROM THE LIST
NCTE C6
LIST
(VCICL(J),
VOICH(J),J =
1,NVCIC)
C7
WRITE TC CRV
43
VIA FORMAT
7C13
FROM THE LIST
NCTE C8
LIST
(VCICL(J),
VOICH(J),J =
1,NVCIC)
,55,C6,
112


AUTOFLOW CHART SET - PNC/SCL DISCRM
NC
53.17
C1
WRITE TO DEV 5 VIA FORMAT 7C15 FROM THE LIST
NOTE C2
LIST = (VC(I),I=1,3), VOICE(J),J = 1,NVOICE
C3
WRITE TO DEV 51 VIA FORMAT 7C15 FROM THE LIST
NOTE C4
LIST = (VC(I),I=1,3), VOICE(J),J = 1,NVOICE
53.18
112
NOTE 05
CONTINUE
C6
NPTS = NASPEIP)
NOTE C7
BEGIN DO LOOP 185 III = 1, NPTS
57.19
C8
READ FROM DEV 5 VIA FORMAT 1C2C INTO THE LIST
NOTE C9
LIST = THETA(III,IP), ICK, NPA, IG, IJPCL
IC
WRITE TO DEV 6 VIA FORMAT 1C21 FROM THE LIST
NOTE 11
LIST = THETA(III,IP), ICK, NPA, EC, IJPCL
12
ICK .GT. C
TRUE
FALSE
13
III .EQ. 1
TRUE
FALSE
A
14
KGCL(III) = 1,IP) .EC. C.
TRUE
FALSE
NOTE 15
BEGIN DO LOOP 185 LLL = 1, IPC
16
KETT(LLL,IP) = KETT - 1,LLL,IP)
115
17
SCIII,LLL,IP) = SIII - 1,LLL,IP)
IF
NC
END OF DO LOOP?
YES
19
KGCL(III,IP) = KGCL(III - 1,IP)
SIGMAX(III,IP) = SIGMAX(III - 1,IP)
DLPMAX(III,IP) = DLPMAX(III - 1,IP)
57.13
... 17C
120
20
NPA .GT. 0
TRUE
FALSE
55.17
125
21
KGCL(III,IP) = 0.
57.04
126
NOTE 22
CONTINUE
23
SIGMAX(III,IP) = THCLD
57.12
... 166
130
24
READ FROM DEV 5 VIA FORMAT 1C3C INTO THE LIST
NOTE 25
LIST = (INPA(I),RR(I), SS(I),I = 1,NPA)
26
WRITE TO DEV 6 VIA FORMAT 1C31 FROM THE LIST
NOTE 27
LIST = (INPA(I),RR(I), SS(I),I = 1,NPA)
129
28
EC .LT. 1.
TRUE
FALSE
155
NOTE 29
CONTINUE
30
RIGPK = SS(1)
31
NPA .EC. 1
TRUE
FALSE
56
04
158
NOTE 32
BEGIN DO LOOP 157 I = 2, NPA
/96.C1

AUTOFLOW CHART SET - FNC/SCL DESCRM



AUTOFLOW CHART SET - FNC/SCL DISCRM



CARD 1	VARIABLE	DEFINITION	COLUMNS
	DBDOWN	Dynamic range of data to be considered	1-10
	RLOW	Minimum range (inches)	11-20
	RHIGH	Maximum range (inches)	21-30
CARD 2	TGTID	Target identification	1-48
	FREQ	Measurement frequency (GHz)	49-55
	NPOL	Number of polarizations	56-60
	NBRTG	Target number	61-66
CARD 3	NWDS	Last point of search for peaks	1-6
	THOLD	Threshold value	7-16
	IRO	First point of search for peaks	17-26
	THINC	Aspect increment of data (deg)	27-36
	DRANG	No. of inches/digital sample	37-46
CARD 4	POLID	Polarization identification	1-12
	NASP	Number of aspect angles	13-18
	THETS	First aspect angle (deg)	19-25
	THETE	Last aspect angle (deg)	26-32
	NVOID	No. of void regions in an otherwise continuous aspect sector	33-36
*CARD 5	VOIDL(I)	First aspect angle of void region (I)	1-5, 11-15...
	VOIDH(I)	Last aspect angle of void region (I)	6-10, 16-20...

I = 1, NVOID

**CARD 6			COLUMNS
	THETA	Aspect angle	1-10
	ICK	Void region indicator =0; in void region =1; not in void region	11-20
	NPN	Number of peaks and nulls	21-30
	EC	Number of peaks	31-40
	IJPOL	Polarization number	41-50
**CARD 7+			
	INPN(I)	Peak/null indicator =1; Null =2; Peak	2,15...
	RR(I)	Location of peak/null (inches)	3-8, 16-21...
	SS(I)	Magnitude of peak/null (dBsm)	9-13, 22-26...
	I=1, NPN		

.
.
.

* Card 5 is not needed if NVOID = 0

\+ May require more than one card if NPN > 5.

** Cards 6 and 7+ are repeated for each aspect angle. Cards 2 through N are punched card output of computer program SPECT.

3.2.1.3.2 Output Data. Discriminant data is transferred to subroutine OUTPUT for output.

3.2.1.3.3 Subroutine Called. Subroutine OUTPUT is called by the executive routine.

3.2.1.4 Listing

A listing of the executive routine is found in the following pages.

3.3.1 Computer Program Subroutine OUTPUT

Subroutine OUTPUT has the function of printing and punching onto cards the discriminant data. Subroutine OUTPUT is written in FORTRAN IV language for use with the GE 635/645 computer system at RADC.

3.3.1.1 Description of Subroutine OUTPUT

In subroutine OUTPUT, the discriminants EQCL, SIGMAX and DLRMAX are printed and punched onto cards for each aspect angle and polarization of interest.

3.3.1.2 Subroutine OUTPUT Flow Chart

A flow chart of subroutine OUTPUT is contained in the following pages.

3.3.1.3 Interfaces

3.3.1.3.1 Input. Input to subroutine OUTPUT consists of the variables in common blocks 1 and 4.

3.3.1.3.2 Output. The output data is described below.

CASE 1: No. of polarizations = 1

CARD 1	VARIABLE	COLUMNS
.	THETA	1-6
.	EQCL	11-15
.	DLRMAX	16-20
.	SIGMAX	21-25
.		
CARD N		

```
C        DISCRM                    1
C                          PROGRAM
C*****  EXTRACT DISCRIMINANTS FROM SIGNATURE DATA
      COMMON/BLOCK1/ THETA(4   ,2),   EQCL(400,2), DLRMAX(400,2),
     1              SIGMAX(4   ,2)
      COMMON/BLOCK2/  R(400,10,2) ,  S(400,10,2)
      COMMON/BLOCK3/  INPN(3  ) ,  BR(30),   SS(30),  NPN
      COMMON/BLOCK4/NPOL,NASP(3),ID
      COMMON/BLOCK7/ TGTID(48  ) ,POLID(3)
C
      DIMENSION
     1  THETS(3)  ,  THETE(3)
     3, VOIDL(3) , VOIDH(3)
C
C
C
C
   10 CONTINUE
      READ (5,10 0)  DBDOWN, RLOW, RHIGH
 1000 FORMAT(6F1 .  )
C
      READ  (5,1003) TGTID,FREQ,NPOL,NBRTGT
 1003 FORMAT( 48A1,F7.2,I5,I6 )
      ID = NBRTGT*1  0+ 3
   25 CONTINUE
   20 CONTINUE
      WRITE (6,7 03) TGTID,FREQ,NPOL,NBRTGT,ID
      WRITE(  3,7 03) TGTID,FREQ,NPOL,NBRTGT,ID
 7003 FORMAT( 48A1,F7.2,I5,I6,                  7H       F  ,I6)
      ID = ID  + 1
      READ  (5,1004) NWDS,THOLD,IRC,THINC,DRANG
 1004 FORMAT( I6,F1 .  ,I10,2F10.  )
      WRITE (6,7 04) NWDS,THOLD,IRC,THINC,DRANG,ID
      WRITE(  3,7 04) NWDS,THOLD,IRC,THINC,DRANG,ID
 7004 FORMAT( I6.F1 .1,I10,F10.1,F10.2,20X,    7H       F  ,I6)
C
      DBDOWN = ABS(DBDOWN)
      WRITE (6,7 01) DBDOWN, RLOW, RHIGH
 7001 FORMAT (3  CONSIDER ONLY PEAKS LESS THAN,F5.1,2 H DB DOWN AND BET
     1WEEN,F7.1, 7H  AND  ,F7.1, 8H  INCHES )
C
C
C
C
      LP = 1
      IF( NPOL .GE. 2 ) LP = 2
C
C
      IP =
  110 IP = IP  + 1
      ID = ID  +1
      READ  (5,1010) POLID,NASP(IP),THETS(IP),THETE(IP),NVOID
```

```
1010 FORMAT( 3A4,I6,2F7.0,I4 )
 111 WRITE(43,7 1 ) POLID,NASP(IP),THETS(IP),THETE(IP),NVOID,ID
     WRITE (6,7 1 ) POLID,NASP(IP),THETS(IP),THETE(IP),NVOID,ID
7010 FORMAT( 3A4,I6,2F7.1,I4,3 X, 7H      P  , I6 )
     IF( NVOID .EQ.  ) GO TO 112
     READ  (5,1 11)( VOIDL(J),VOIDH(J),J=1,NVOID )
1011 FORMAT ( 1 F6.  )
     GO TO (5 ,60,7 ,8 ,90),NVOID
  50 WRITE (6,7 11)  (VOIDL(J), VOIDH(J),J=1,NVOID)
     WRITE(43,7 11)  (VOIDL(J), VOIDH(J),J=1,NVOID)
7011 FORMAT ( 2F6.1, 54X,7H       P,I6)
     GO TO 112
  60 WRITE (6,7 12)  (VOIDL(J), VOIDH(J),J=1,NVOID)
     WRITE(43,7 12)  (VOIDL(J), VOIDH(J),J=1,NVOID)
7012 FORMAT ( 4F6.1, 42X,7H       P,I6)
     GO TO 112
  70 WRITE (6,7 13)  (VOIDL(J), VOIDH(J),J=1,NVOID )
     WRITE(43,7 13)  (VOIDL(J), VOIDH(J),J=1,NVOID)
7013 FORMAT ( 6F6.1, 3 X,7H       P,I6)
     GO TO 112
  80 WRITE (6,7 14)  (VOIDL(J), VOIDH(J),J=1,NVOID)
     WRITE(43,7 14)  (VOIDL(J), VOIDH(J),J=1,NVOID)
7014 FORMAT ( 8F6.1, 18X,7H       P,I6)
     GO TO 112
  90 WRITE (6,7 15)  (VOIDL(J), VOIDH(J),J=1,NVOID)
     WRITE(43,7 15)  (VOIDL(J), VOIDH(J),J=1,NVOID)
7015 FORMAT (1 F6.1,  6X,7H       P,I6)
 112 CONTINUE
C
     NPTS  = NASP(IP)
C
     DO 185 III=1,NPTS
     READ  (5,1 2 ) THETA(III,IP),ICK,NPN,EC
    1,IJPOL
1020 FORMAT( F1 . ,9X,I1,I1 ,F1 .0,I10 )
     WRITE (6,1 21) THETA(III,IP),ICK,NPN,EC,IJPOL
1021 FORMAT( F1 .1,2I1 ,F1 .1,I10 )
C
     IF( ICK .GT. 0 ) GO TO 120
     IF( III .EQ. 1 ) GO TO 125
     IF(  EQCL(III-1,IP) .EQ.  .) GO TO 125
     DO 115 LLL=1,IEC
     R(III,LLL,IP) = R(III-1,LLL,IP)
 115 S(III,LLL,IP) = S(III-1,LLL,IP)
      EQCL (III,IP)=  EQCL (III-1,IP)
     SIGMAX(III,IP)= SIGMAX(III-1,IP)
     DLRMAX(III,IP)= DLRMAX(III-1,IP)
      GO TO 17
C
 120 IF(NPN .GT. 0 ) GO TO 130
 125  EQCL (III,IP) = 0.
 126 CONTINUE
```

```
      SIGMAX(III,IP) = THOLD
      GO TO 166
C
  130 READ  (5,1030)(INPN(I),RR(I),SS(I),I=1,NPN)
 1030 FORMAT( (1X,5(I1,F6.1,F5.1,1X)) )
      WRITE (6,1031)(INPN(I),RR(I),SS(I),I=1,NPN)
 1031 FORMAT( (1X,5(I1,F6.1,F5.1,1X)) )
C
  129 IF( EC .LT. 1.) GO TO 125
C
  155 CONTINUE
      BIGPK = SS(1)
      IF ( NPN .EQ. 1 )  GO TO 158
      DO 157  I = 2,NPN
      IF (SS(I) .GT. BIGPK ) BIGPK = SS(I)
  157 CONTINUE
  158 CONTINUE
      BASE = BIGPK - D3DOWN
      IEC =
      DO 160 I=1,NPN
      IF( INPN(I) .NE. 2 ) GO TO 160
      IF( SS(I) .LT. BASE ) GO TO 160
      IF ((RR(I) .GE. RLOW) .AND. (RR(I) .LE. RHIGH )) GO TO 159
      GO TO 160
  159 IEC = IEC + 1
      R(III,IEC,IP) =RR(I)
      S(III,IEC,IP) =SS(I)
  160 CONTINUE
C
       EQCL(III,IP) = IEC
      IF( IEC .LT. 1 ) GO TO 126
      JMAX = 1
      SIGMAX(III,IP) = S(III,1,IP)
      DO 165 IK=1,IEC
      IF( S(III,IK,IP) .LE. SIGMAX(III,IP) ) GO TO 165
      SIGMAX(III,IP) = S(III,IK,IP)
      JMAX = IK
  165 CONTINUE
      IF( IEC .LT. 2 ) GO TO 166
      DLRMAX(III,IP) = R(III,IEC,IP) - R(III,1,IP)
      GO TO 17
  166 DLRMAX(III,IP) = 0.
C
  170 CONTINUE
  176 CONTINUE
C
C
  180 CONTINUE
  185 CONTINUE
C
      IF( II .LT. LP ) GO TO 11
C
```

```
  270 CONTINUE
C
      CALL        OUTPUT
  300 CONTINUE
      GO TO 1
      END
      SUBROUTINE OUTPUT
      COMMON/BLOCK1/ THETA(400,2),    EQCL(400,2), DLRMAX(400,2),
     1               SIGMAX(400,2)
C
      COMMON/BLOCK4/NPOL,NASP(3),ID
C
      NPTS = NASP(1)
C
C
      WRITE (6,2000)
 2000 FORMAT (///5OH THETA   ECV   DLRMXV SIGMXV      ECH   DLRMXH SIGMXH )
C
      GO TO (10,20,20),NPOL
C
   10 DO 12 I=1,NPTS
      ID = ID + 1
      WRITE(6,2010) THETA(I,1),EQCL(I,1),DLRMAX(I,1),SIGMAX(I,1),ID
 2010 FORMAT( F6.1,F5.1,1X,2(1X,F6.1), 40X,      7H       P ,I6)
      WRITE(43,1000)THETA(I,1),EQCL(I,1),DLRMAX(I,1),SIGMAX(I,1),ID
 1000 FORMAT( F6.1,4X,3F5.1, 41X,                 7H       P ,I6)
C
   12 CONTINUE
      RETURN
C
C
   20 CONTINUE
      DO 3  I=1,NPTS
      ID = ID + 1
      WRITE(6,2020) THETA(I,1),EQCL(I,1),DLRMAX(I,1),SIGMAX(I,1),
     1                         EQCL(I,2),DLRMAX(I,2),SIGMAX(I,2),ID
 2020 FORMAT( F6.1,F5.1,1X,2(1X,F6.1),2X,F5.1,1X,2(1X,F6.1),18X,7H
     1 ,I6)
      WRITE(43,1010)THETA(I,1),EQCL(I,1),DLRMAX(I,1),SIGMAX(I,1),
     1                         EQCL(I,2),DLRMAX(I,2),SIGMAX(I,2),ID
 1010 FORMAT( F6.1,9X,6F5.1, 26X,                 7H       P ,I6)
C
   30 CONTINUE
C
C
      RETURN
      END
#28.0         134.5     165.0
 MODEL 6/14     TWO SHPERES, ONE JACK                    9.00     1      1
   450      -52.9          200          1.0        0.51
 VERT/VERT        91    0.0    90.
        0.0                    7          3.0            1
```

```
1 122.6-52.8 2 135.9-21.8 1 14 .6-40.4 2 148.3-26.1 1 154.9-51.8
2 162.6-28.6 1 164.7-46.7 2 168.3-42.2 1 171.3-53.2
      1.0                    7       3.0          1
1 123.1-52.8 2 136.5-21.6 1 14 .0-40.6 2 148.3-25.0 1 154.4-51.8
2 163.1-29.4 1 164.2-46.8 2 167.8-42.1 1 170.8-53.6
      2.0                    7       3.0          1
1 124.1-52.7 2 136.5-21.5 1 14 .6-41.5 2 148.8-27.1 1 154.9-52.1
2 162.6-31.  1 165.2-46.3 2 167.8-43.1 1 171.3-54.9
      3.0                    7       3.0          1
1 123.6-53.1 2 136.5-21.8 1 14 .6-42.4 2 148.8-27.4 1 154.9-52.3
2 161.1-35.6 1 164.7-46.5 2 167.8-43.9 1 170.8-53.5
      4.0                   11       5.0          1
1 122.6-54.  2 126.2-49.5 1 127.7-49.6 2 137.0-22.6 1 140.6-42.6
2 149.3-29.3 1 150.9-52.7 2 161.1-38.8 1 166.2-47.0 2 168.3-46.1
1 170.8-53.6
      5.0                    8       3.0          1
1 124.1-52.9 2 135.9-22.0 1 141.1-43.5 2 147.7-30.3 1 154.4-53.3
1 157.0-53.3 2 161.6-45.7 1 17 .3-53.9
      6.0                    8       3.0          1
1 123.6-53.7 2 136.5-21.8 1 141.1-44.4 2 148.3-31.3 1 154.4-53.9
1 162.6-53.  2 167.2-49.6 1 169.8-53.8
      7.0                   11       4.0          1
1 125.2-54.  2 136.5-21.9 1 141.6-45.4 2 148.3-32.5 1 154.4-53.4
1 156.0-53.9 2 159.5-45.9 1 162.1-53.4 1 166.2-53.5 2 171.3-55.2
1 173.4-53.8
      8.0                    7       3.0          1
1 125.2-52.7 2 136.5-22.4 1 142.1-47.9 2 148.8-34.3 1 154.9-51.6
2 159.5-41.6 1 169.3-52.9
      9.0                    9       4.0          1
1 125.2-52.8 2 136.5-22.1 1 142.6-50.8 2 148.3-35.5 1 154.9-50.3
2 160.1-38.6 1 162.6-47.5 2 164.2-46.2 1 169.3-53.1
      10.0                   7       3.0          1
1 126.2-53.  2 136.5-22.2 1 142.1-45.6 2 146.2-35.0 1 154.4-48.7
2 159.5-36.2 1 168.8-53.0
      11.0                   9       4.0          1
1 125.7-54.4 2 136.5-21.6 1 141.1-43.8 2 148.3-32.7 1 153.9-48.4
2 160.1-35.4 1 163.1-48.8 2 164.7-48.0 1 169.8-53.9
      12.0                   7       3.0          1
1 127.2-53.2 2 136.5-21.9 1 14 .6-42.7 2 148.3-32.6 1 154.4-48.4
2 161.6-33.5 1 169.3-52.9
      13.0                   7       3.0          1
1 127.2-53.  2 136.5-21.9 1 14 .6-41.6 2 148.3-30.0 1 152.9-49.1
2 161.1-32.3 1 168.3-54.7
      14.0                   8       3.0          1
1 126.2-53.1 2 136.5-21.7 1 14 .6-41.8 2 147.7-29.0 1 153.9-50.8
2 160.6-31.3 1 166.2-53.4 1 171.3-53.6
      15.0                   8       3.0          1
1 127.2-52.2 2 136.5-21.5 1 14 .6-42.5 2 147.7-26.9 1 153.4-52.3
1 153.9-52.5 2 161.1-29.1 1 166.7-53.3
      16.0                   8       3.0          1
1 126.7-52.9 2 137. -21.8 1 14 .6-45.5 2 148.8-25.9 1 152.9-52.8
1 153.9-53.5 2 162.1-27.5 1 166.2-53.8
```

```
      17.0                    1          7          3.0                    1
1 127.7-52.3 2 136.5-21.9 2 141.1-45.7 2 148.3-24.4 1 153.9-51.9
2 161.1-26.7 1 166.7-53.1
      18.0                    1          8          3.0                    1
1 126.2-53.  2 137. -21.9 2 14 .0-43.6 2 148.8-22.9 1 153.4-50.5
2 161.1-25.8 1 166.2-53.2 2 174.4-53.8
      19.0                    1         11          4.0                    1
1 121.1-53.6 1 125.7-53.1 2 136.5-20.8 1 140.6-42.8 2 147.7-21.4
1 153.4-48.2 2 160.6-24.7 2 166.7-52.9 1 171.3-52.8 2 172.9-49.0
1 175.4-54.7
      20.0                    1          9          3.0                    1
1 125.2-53.7 2 137. -21.6 2 14 .0-40.4 2 148.3-21.1 1 152.9-44.8
2 161.6-24.4 1 170.3-53.8 2 17 .8-53.1 1 180.6-53.4
      21.0                    1          8          3.0                    1
1 117.5-53.3 2 136.5-21.7 2 14 .0-38.5 2 147.2-20.9 1 152.4-43.7
2 160.6-24.6 1 178. -54.0 2 183.7-53.1
      22.0                    1          8          4.0                    1
1 117.5-53.3 2 136.5-21.4 2 141.6-34.6 2 147.2-20.3 1 152.4-44.4
2 160.1-24.2 1 167.8-51.4 2 169.3-49.7
      23.0                    1         15          6.0                    1
1 112.9-53.  2 114.4-51.7 2 117.0-52.8 1 117.5-53.0 2 12 .0-50.8
1 127.2-51.7 2 137. -21.2 2 142.6-34.9 2 147.7-19.6 1 152.9-46.5
2 160.6-23.3 1 167.8-53.0 2 168.8-53.2 2 173.4-47.4 1 175.4-52.9
      24.0                    1         13          5.0                    1
1 115.9-53.3 2 136.5-21.8 2 142.1-36.1 2 147.7-20.1 1 152.4-46.6
2 160.6-22.5 1 169.3-52.8 2 17 .3-53.1 2 172.4-47.5 1 177.0-52.9
1 180.1-54.1 2 182.6-50.9 2 185.2-53.6
      25.0                    1         15          6.0                    1
1 113.4-53.7 2 121.1-51.6 2 123.1-52.3 2 124.7-50.9 1 127.2-51.9
2 137.5-21.5 1 141.6-35.4 2 148.3-18.9 1 152.9-47.3 2 161.1-21.8
1 171.9-53.1 1 173.4-53.1 2 18 .1-53.4 2 183.7-50.0 1 186.2-54.1
      26.0                    1         12          4.0                    1
1 111.8-52.8 2 137.5-21.3 2 14 .0-41.5 2 147.7-19.2 1 152.9-47.5
2 160.6-21.6 2 175.4-53.3 2 18 .6-53.3 2 183.1-50.3 1 186.2-52.8
1 192.4-52.9 1 194.4-53.1
      27.0                    1         19          8.0                    1
1 112.3-52.8 1 119. -52.7 2 119.5-53.0 2 122.1-50.4 2 137.5-21.1
1 139.5-41.4 2 147.7-18.6 2 151.3-43.4 2 160.6-22.2 2 171.3-48.7
1 174.4-54.4 1 176.5-52.9 2 178.0-50.3 1 180.6-53.7 1 181.6-52.9
2 183.7-5 .  1 187.2-52.6 2 189.8-51.3 1 192.4-53.3
      28.0                    1         14          6.0                    1
1 117.5-53.  2 123.6-50.9 2 126.2-51.9 2 138.0-20.8 1 141.6-33.1
2 148.3-18.4 1 151.8-41.4 2 16 .6-22.2 1 176.0-52.9 2 178.0-50.3
1 182.1-53.  1 182.6-53.0 2 184.2-50.4 1 186.7-53.
      29.0                    1         14          6.0                    1
1 114.4-52.9 2 12 . -50.6 2 123.1-51.7 2 137.5-21.2 1 142.1-33.6
2 147.7-19.8 1 152.4-41.1 2 16 .1-23.2 1 167.2-50.5 2 170.3-49.0
1 173.4-53.  1 181.6-53.0 2 184.7-51.3 1 186.7-53.
      30.0                    1         14          6.0                    1
1 111.8-53.6 1 115.4-53.5 2 12 .6-51.2 1 123.6-52.8 2 126.2-51.4
1 127.7-52.3 2 137.5-21.5 2 141.6-33.3 2 147.7-20.2 1 152.4-43.6
2 160.1-24.8 1 168.8-53.9 2 171.3-48.9 1 174.4-53.4
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      31.0                                  11          4.0                 1
1 117.0-53.5 2 12 .6-51.5 1 122.6-52.2 2 137.5-21.0 1 142.1-34.3
2 147.7-21.8 1 151.8-44.3 2 16 .1-24.7 1 166.2-53.6 1 168.8-53.1
1 172.9-53.
      32.0                                  11          4.0                 1
1 123.6-53.3 2 12 6.2-51.7 1 128.2-52.1 2 137.0-21.2 1 140.6-40.8
2 147.2-22.3 1 152.4-47.5 2 159.0-24.6 1 164.7-52.9 1 170.3-53.6
1 184.7-53.6
      33.0                                  13          5.0                 1
1 119.0-53.8 2 12 .6-52.4 1 123.1-53.2 1 125.7-53.1 2 137.5-21.1
1 140.6-4 .9 2 147.7-22.5 1 151.8-45.7 2 159.5-25.7 1 166.7-52.9
1 169.3-52.8 2 176. -54.7 1 178.0-53.5
      34.0                                   6          3.0                 1
1 126.2-52.9 2 138. -21.4 2 148.3-21.9 1 151.8-41.5 2 159.5-26.2
1 166.7-53.3
      35.0                                  10          5.0                 1
1 119.5-53.1 2 12 6.2-50.6 1 127.7-51.1 2 138.0-20.9 1 141.6-32.8
2 147.7-22.  1 152.4-40.8 2 159.0-26.0 2 170.3-49.0 1 173.4-53.6
      36.0                                  12          5.0                 1
1 117.5-53.1 2 124.7-51.0 1 12 6.7-51.7 2 138.0-20.6 1 142.1-32.8
2 147.7-21.2 1 151.8-43.7 2 159.0-25.7 1 165.7-53.3 1 168.3-54.6
2 170.3-49.8 1 172.4-53.1
      37.0                                  13          6.0                 1
2 121.1-51.7 1 123.1-52.6 2 125.2-51.2 1 127.7-52.5 2 138.5-20.8
1 142.1-32.8 2 148.3-20.5 1 15 .8-45.4 2 160.1-25.2 1 166.2-53.0
2 167.8-5 .4 1 169.8-54.1 1 175.4-53.0
      38.0                                  17          6.0                 1
1 115.9-52.9 1 122.1-52.7 2 138.5-20.8 1 142.1-36.5 2 147.7-20.3
1 151.8-45.3 2 159. -24.0 2 163.6-49.9 2 165.2-48.3 1 169.3-51.5
1 173.9-53.7 1 181.6-53.3 2 183.7-51.6 1 186.2-52.9 1 187.2-53.1
2 189.8-5 . 1 192.9-53.1
      39.0                                  11          4.0                 1
1 114.4-53.1 1 121.6-53.0 2 125.2-50.5 2 139.0-20.8 2 148.8-19.3
1 150.8-38.6 2 159.5-22.5 1 168.3-51.3 1 171.9-53.4 1 177.0-53.1
1 182.6-51.9
      40.0                                  12          5.0                 1
1 109.3-52.9 2 125.7-50.4 1 128.8-51.3 2 139.0-20.4 1 142.6-31.9
2 148.3-19.2 1 151.3-37.4 2 159.0-22.6 1 167.8-51.2 2 17 .3-47.5
1 172.9-53.4 1 179. -53.5
      41.0                                  15          6.0                 1
1 112.3-53.1 2 124.7-50.3 1 129.3-50.2 2 139.0-20.3 1 142.6-31.3
2 147.7-19.2 1 151.8-40.6 2 15 .5-23.4 1 166.2-53.0 1 168.3-54.1
2 169.8-49.9 1 171.9-52.7 2 173.9-49.0 1 177.0-52.9 1 182.1-53.0
      42.0                                  11          6.0                 1
2 139.5-21.1 2 148.3-20.8 2 15 .8-42.4 2 159.0-23.3 1 162.6-51.1
2 164.2-48.2 1 166.2-51.5 2 167.8-49.2 1 170.3-53.0 1 181.6-53.7
2 194.4-49.7
      43.0                                  12          5.0                 1
1 121.6-51.8 2 139.5-20.7 2 148.3-20.8 1 151.3-40.6 2 158.5-23.4
1 162.1-47.3 2 164.7-46.7 1 173.9-52.7 2 176.0-50.5 1 178.5-53.1
1 182.6-52.8 1 188.8-52.6
      44.0                                  1           4.0                 1
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1 113.9-54.4 1 123.6-52.7 2 125.2-50.8 1 127.7-52.5 2 138.5-21.0
1 142.6-32.5 2 147.2-21.2 2 152.9-34.3 2 158.0-23.4 1 168.3-51.8
     45.0              1          10        4.0              1
1 109.8-53.5 1 129.3-52.4 2 139.5-20.5 1 143.6-29.1 2 147.7-20.5
1 152.9-36.8 2 158.0-24.7 1 166.7-52.0 2 169.3-48.7 1 178.0-54.5
     46.0              1          13        6.0              1
2 139.0-20.8 1 143.6-31.4 2 147.2-20.6 1 150.3-42.4 2 157.5-24.7
1 161.6-50.9 2 163.1-47.1 2 165.2-52.8 1 182.6-53.5 2 184.7-51.6
1 186.7-52.7 1 191.9-52.7 2 194.4-50.7
     47.0              1          17        7.0              1
1 115.4-53.9 2 117.0-51.8 2 119.5-53.3 2 121.1-51.9 1 123.6-53.5
2 139.5-20.9 2 147.7-20.3 1 150.8-42.6 2 157.5-24.4 1 161.6-50.9
2 163.6-46.7 1 167.2-52.5 2 173.4-53.1 1 184.2-53.0 1 187.8-53.2
2 190.3-51.0 1 193.4-53.3
     48.0              1          12        6.0              1
1 116.5-53.9 2 121.1-51.8 2 122.6-52.5 2 125.2-51.7 2 140.0-21.6
1 143.6-31.9 2 148.3-19.9 1 151.8-33.1 2 157.5-24.1 1 162.1-51.2
2 163.6-48.0 1 167.2-52.9
     49.0              1          12        6.0              1
1 112.3-53.3 2 118.4-51.3 2 127.2-50.1 1 128.8-51.3 2 140.0-20.7
1 143.1-27.7 2 147.7-18.4 1 152.9-33.5 2 157.5-23.5 1 164.2-52.8
2 168.3-49.2 1 176.5-53.2
     50.0              1          17        7.0              1
2 118.5-51.1 1 121.1-52.7 2 122.6-50.9 1 125.2-51.8 2 139.0-20.4
1 143.1-28.9 2 147.2-19.1 1 150.3-40.1 2 156.5-23.2 1 161.1-50.0
2 163.1-45.7 1 165.7-53.0 2 169.3-53.9 1 175.4-53.7 1 186.7-53.7
1 189.3-53.2 2 193.9-50.0
     51.0              1          17        7.0              1
1 115.4-53.3 2 118.0-52.2 2 119.5-53.1 2 140.0-20.9 2 147.2-20.3
1 151.8-36.7 2 157.0-23.1 2 161.1-51.3 2 163.1-48.1 1 166.7-51.6
1 173.4-53.7 2 175.4-51.5 1 178.0-53.5 1 181.6-53.2 1 188.8-53.5
2 190.3-51.8 1 190.9-53.3
     52.0              1          11        5.0              1
1 116.5-52.9 2 124.7-50.7 2 140.6-21.4 1 143.6-30.5 2 148.3-20.4
1 152.4-31.8 2 157.0-23.3 2 166.7-50.2 2 168.3-49.1 1 170.3-52.5
1 178.5-53.1
     53.0              1          10        3.0              1
1 115.9-52.4 1 119.5-51.7 2 129.8-51.7 2 140.0-20.9 1 143.6-27.0
2 147.2-21.3 1 152.9-32.6 2 156.5-23.7 1 162.6-52.8 1 178.0-53.9
     54.0              1          17        7.0              1
1 115.4-53.2 2 124.7-50.8 1 129.3-51.9 2 141.1-21.0 1 144.2-28.1
2 147.2-21.1 1 149.8-43.5 2 156.5-24.3 2 162.6-47.1 1 165.2-53.0
1 168.8-53.3 1 176.0-53.9 1 182.6-53.5 2 186.2-53.5 1 188.3-53.6
1 188.8-53.5 2 193.4-49.5
     55.0              1          11        6.0              1
2 121.1-51.5 1 123.6-52.5 2 140.0-20.6 2 147.2-20.4 1 149.3-40.1
2 156.0-24.3 2 167.8-50.2 2 169.8-53.4 1 179.5-53.2 2 182.6-53.3
1 184.7-53.7
     56.0              1          12        5.0              1
1 118.0-53.2 2 121.1-51.5 2 123.6-52.3 2 127.2-51.2 1 129.8-52.3
2 141.1-21.1 1 144.2-27.9 2 148.3-19.9 1 152.4-30.5 2 156.5-23.8
1 170.3-53.0 1 171.9-52.8
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      57.0                  1                 17          7.0                  1
1 112.3-53.1 2 116.5-51.3 2 124.1-50.5 1 126.7-51.8 2 141.1-20.9
1 144.2-24.9 2 147.2-20.1 2 152.4-31.9 2 155.4-25.4 1 164.7-53.0
1 168.8-54.4 2 17 .3-50.0 2 172.4-53.4 1 174.4-53.7 2 176.0-50.6
1 179.5-53.7 1 194.4-52.3
      58.0                  1                 16          7.0                  1
1 115.4-52.9 2 119.5-51.4 2 129.8-50.5 1 131.3-51.9 2 141.6-20.6
1 144.7-26.4 2 148.3-19.2 2 156.5-23.6 1 160.1-50.9 2 161.6-46.2
1 166.2-53.2 1 166.7-53.1   181.6-52.9 1 186.2-53.4 1 186.7-53.0
2 191.3-48.2
      59.0                  1                 14          6.0                  1
1 114.4-53.2 2 115.9-52.3 2 116.0-52.8 1 118.5-52.9 2 141.6-21.3
2 147.7-19.9 1 151.3-29.9 2 155.4-23.4 1 159.5-50.6 2 161.1-47.9
1 165.7-52.6 1 176.5-53.0 2 179.0-52.0 1 181.6-53.0
      60.0                  1                 14          6.0                  1
1 112.3-53.4 1 119.5-52.5 2 122.1-50.5 1 127.7-51.1 2 142.1-20.5
1 144.7-24.3 2 148.3-19.1 2 151.8-27.4 2 156.0-22.8 1 162.1-50.9
2 166.2-48.9 1 171.9-52.7 2 173.4-50.6 1 175.4-52.7
      61.0                  1                 17          7.0                  1
1 111.8-54.  2 124.7-50.8 2 142.1-20.6 1 144.7-23.7 2 147.7-20.5
1 150.8-33.2 2 154.9-23.8   16 .1-49.5 2 161.6-47.3 1 164.2-52.5
1 167.8-53.2 1 175.4-53.7 2 177.5-50.9 1 179.5-53.2 1 182.6-53.4
1 187.8-53.  2 191.9-49.8
      62.0                  1                  9          4.0                  1
1 116.5-52.9 2 120.6-51.0 2 122.1-51.5 2 142.1-21.4 1 145.2-28.8
2 148.3-2 .9 2 155.4-24.3 2 166.2-52.6 1 177.5-53.1
      63.0                  1                 12          5.0                  1
1 113.4-53.5 1 117.5-52.8 2 142.6-21.7 1 144.7-27.0 2 147.7-20.1
1 151.3-29.2 2 155.4-23.3 2 159.5-49.2 2 161.1-46.7 1 162.6-50.4
2 164.7-49.4 1 168.8-53.8
      64.0                  1                 19          7.0                  1
1 112.3-53.  2 115.4-50.6 2 117.0-52.3 2 123.6-50.3 2 142.6-20.0
1 145.2-22.1 2 147.2-19.7 2 151.3-28.3 2 154.4-25.1 1 163.1-53.1
1 163.6-53.4 2 165.7-48.7 2 171.3-53.2 1 173.4-53.1 2 177.0-49.8
1 180.6-52.5 1 182.6-53.4 2 188.8-52.9 1 193.9-53.1
      65.0                  1                 17          6.0                  1
1 119.5-53.7 1 12 .-53.3 2 127.7-52.7 1 131.8-53.6 2 142.6-20.4
1 144.7-23.5 2 147.7-20.2 2 15 .8-32.6 2 154.4-25.0 1 165.2-53.4
1 177.0-54.7 2 179.5-50.7 2 182.1-53.1 2 184.7-51.4 1 188.3-53.3
1 189.3-53.6 2 191.9-50.8
      66.0                  1                 10          5.0                  1
1 125.2-53.  2 128.2-50.8 2 143.1-21.8 1 145.2-31.1 2 148.3-19.8
1 151.3-26.8 2 154.4-22.7 2 158.0-50.9 2 159.5-47.3 1 164.2-53.3
      67.0                  1                 11          5.0                  1
1 111.8-53.  2 148.3-18.4 2 151.8-25.5 2 154.4-22.8 1 156.0-43.5
2 157.5-42.1 1 162.6-51.5 2 164.7-46.6 1 172.4-53.4 2 176.0-51.5
1 178.0-53.1
      68.0                  1                 17          7.0                  1
1 113.9-53.4 1 118. -52.6 2 129.3-50.5 1 132.4-51.3 2 144.2-19.3
1 151.8-33.2 2 154.9-24.2   16 .6-50.8 2 162.1-47.1 1 164.2-52.6
1 177.5-52.8 2 179.5-51.0 2 181.6-52.5 2 184.2-50.2 1 187.8-52.5
2 189.8-5 .4 1 193.4-51.3
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      69.0                          11          5.0                1
1 117.5-52.7 2 12 .6-50.8 2 142.1-22.3 1 144.7-30.4 2 147.2-21.4
1 149.8-29.7 2 152.4-23.4   161.1-49.2 2 162.6-48.0 1 164.7-52.6
1 182.1-52.6
      70.0                          11          5.0                1
1 113.9-52.9 2 13 .8-50.0   132.4-50.5 2 144.2-20.4 1 145.7-21.5
2 147.2-19.4 1 151.8-25.1 2 153.9-22.9 1 163.1-50.6 2 165.7-46.2
1 172.4-53.1
      71.0                          14          6.0                1
1 117.0-53.4 2 12 . -50.9   121.6-51.9 2 123.1-51.0 2 143.6-17.8
1 150.8-25.9 2 152.4-24.0   165.7-53.7 1 169.3-53.1 1 177.0-53.5
2 183.7-49.9 1 188.3-51.5 2 189.8-50.4 1 192.4-52.4
      72.0                          13          6.0                1
1 115.4-53.1 2 13 .3-50.0 2 143.6-22.8 1 145.2-25.7 2 147.7-21.9
1 150.3-3 .8 2 152.9-24.7 2 161.6-47.9 1 165.7-53.1 1 169.3-52.6
1 178.5-53.4 2 192.4-55.2   194.4-53.4
      73.0                          13          5.0                1
1 113.9-52.9 1 119.5-53.1 2 144.7-21.1 1 146.2-23.0 2 148.3-19.1
1 150.8-22.1 2 152.9-21.6   156.0-47.7 2 158.5-42.8 1 162.1-52.2
2 164.7-48.5 1 167.8-53.0   171.3-53.7
      74.0                          14          6.0                1
1 113.9-53.9 2 115.9-52.4   117.5-52.7 2 122.1-51.1 1 126.2-51.6
2 145.7-17.1 1 151.3-26.7 2 152.9-25.7 1 160.6-52.6 2 163.6-50.6
1 165.2-53.3 1 179. -53.6 2 184.2-50.6 1 186.2-52.7
      75.0                          11          4.0                1
1 118.5-52.9 2 146.7-21.5   149.8-31.1 2 152.4-22.2 1 160.1-51.3
2 161.6-46.8 1 166.2-53.7   167.2-53.9 1 177.5-53.6 2 180.1-50.9
1 182.1-53.3
      76.0                          7           3.0                1
1 119.5-52.9 2 148.3-20.9   150.8-23.7 2 152.4-23.1 1 161.6-50.6
2 164.2-48.8 1 166.2-53.1
      77.0                          14          5.0                1
1 114.4-52.7 1 126.2-51.5 2 13 .8-49.3 1 133.9-50.5 2 147.2-16.5
1 160.6-52.5 2 163.1-48.3   168.3-52.5 1 170.8-52.8 1 175.4-53.0
2 182.1-48.3 1 185.7-51.2 2 188.3-49.7 1 191.9-52.6
      78.0                          8           3.0                1
1 120.0-53.4 2 146.2-19.9 2 152.4-26.7 1 159.0-50.9 2 161.1-49.2
1 164.7-53.6 1 167.2-53.2   183.1-53.4
      79.0                          8           3.0                1
1 113.9-52.9 2 121.6-30.6 2 144.7-26.5 1 146.2-29.1 2 148.3-21.7
1 159.0-47.7 1 167.8-52.8   171.3-52.9
      80.0                          15          6.0                1
1 111.8-53.6 2 122.6-49.3   129.3-50.8 2 132.4-49.6 1 135.9-49.9
2 146.7-15.7 1 16 .6-50.7 2 162.6-48.7 1 172.4-53.3 1 176.5-53.7
2 183.7-49.  1 186.2-52.3 2 188.3-52.1 1 190.3-53.3 1 192.9-53.2
      81.0                          15          6.0                1
1 120.6-53.1 2 123.6-53.8   125.7-53.3 2 131.3-51.2 1 134.4-52.8
2 146.7-18.1 1 149.8-29.5 2 151.8-25.3 1 155.4-48.9 2 157.5-45.9
1 164.7-53.2 1 166.7-55.4   179.5-53.1 2 182.1-51.3 1 184.7-53.8
      82.0                          9           4.0                1
1 119.5-53.1 2 128.2-51.0   131.3-52.6 2 145.2-30.2 1 146.7-34.5
2 151.3-23.7 1 158. -51.5 2 162.1-49.2 1 164.7-52.8
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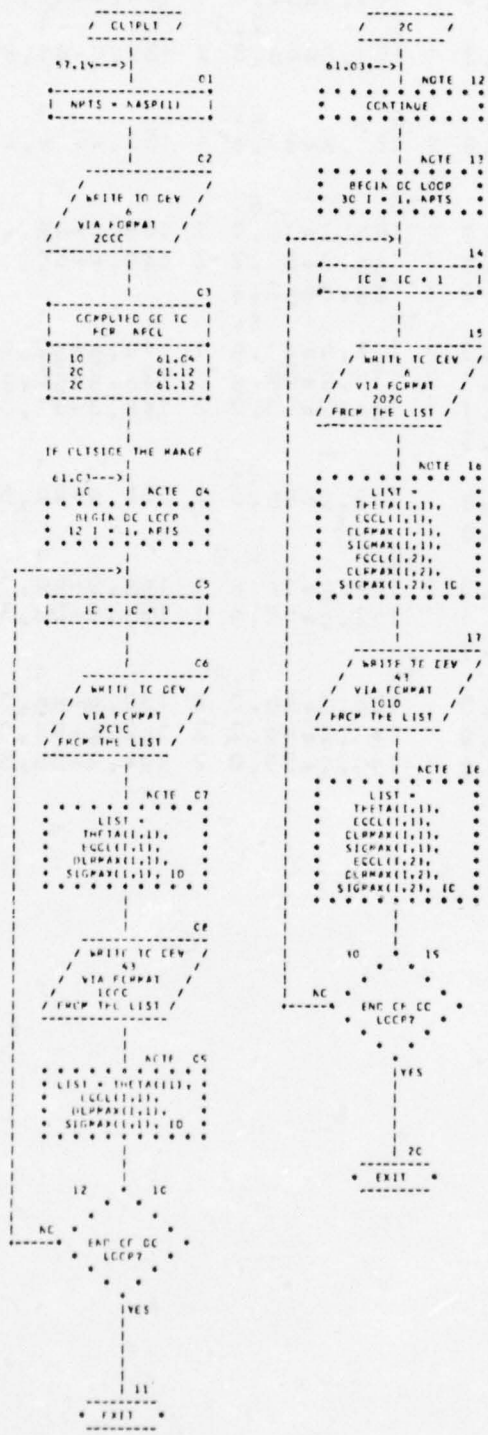
      83.0                1                  9          4.0                1
1  108.2-52.9  2  127.2-48.9  2  147.2-15.6  1  159.0-49.7  2  161.6-48.0
1  177.5-52.3  2  183.7-47.4  1  189.3-52.8  1  194.4-52.4
      84.0                1                  6          2.0                1
1  120.0-53.   2  146.7-17.3  1  157.5-46.5  2  159.0-45.8  1  167.8-53.1
1  181.1-53.4
      85.0                1                  6          2.0                1
1  132.9-53.8  1  137.5-52.8  2  15 .8-23.6  1  153.4-44.4  2  154.9-43.3
1  158.0-52.4
      86.0                1                 13          6.0                1
1  110.3-53.5  2  123.6-48.9  2  147.2-15.9  1  159.0-48.4  2  161.6-46.7
1  164.7-5 .4  2  166.2-49.7  1  168.3-51.2  2  169.8-50.1  1  173.4-53.0
1  178.0-52.7  2  183.1-48.2  1  188.3-52.6
      87.0                               17          8.0                1
1  108.2-53.3  1  111.8-53.3  2  114.4-51.8  1  117.5-52.9  2  122.6-49.7
1  126.2-51.4  2  128.8-50.1  2  134.9-49.6  1  136.5-50.5  2  147.7-17.7
1  156.5-47.4  2  158.5-44.1  1  166.2-53.2  2  168.3-51.0  1  170.3-53.1
1  179.5-53.1  2  194.4-55.3
      88.0                1                  7          3.0                1
1  139.5-53.5  2  149.8-23.8  1  152.9-48.0  2  154.9-44.5  1  157.0-50.3
2  159.0-48.7  1  162.6-53.8
      89.0                1                 12          4.0                1
1  112.3-52.8  1  134.4-50.0  2  149.8-16.8  1  156.0-49.0  2  160.1-47.3
1  168.3-51.8  2  169.8-50.1  1  172.9-52.9  1  177.0-53.5  2  184.2-47.6
1  188.8-53.8  1  193.9-52.7
      90.0                               14          7.0                1
1  109.3-53.4  2  127.7-48.5  1  129.3-49.0  2  130.8-48.0  2  147.2-16.1
1  157.0-46.3  2  158.5-43.9  1  160.6-49.2  2  162.6-48.0  1  166.2-51.5
2  167.8-5 .3  1  171.3-52.9  1  179.0-53.0  2  194.4-55.5
```

CHART TITLE - SUBROUTINE OUTPUT



CASE 2: No. of polarizations = 2

CARD 1	VARIABLE		COLUMNS
	THETA		1-6
	EQCL	(POL. 1)	11-15
	DLRMAX	(POL. 1)	16-20
	SIGMAX	(POL. 1)	21-25
	EQCL	(POL. 2)	26-30
	DLRMAX	(POL. 2)	31-35
	SIGMAX	(POL. 2)	36-40

3.3.1.3.3 Calling Subroutine. Subroutine OUTPUT is called by the executive routine.

3.3.1.4 Listing

A complete listing of OUTPUT is contained in the following pages.

```
      SUBROUTINE OUTPUT
      COMMON/BLOCK1/ THETA(400,2),   EQCL(400,2), DLRMAX(400,2),
     1               SIGMAX(400,2)
C
      COMMON/BLOCK4/NPOL,NASP(3),ID
C
      NPTS = NASP(1)
C
C
      WRITE (6,2000)
 2000 FORMAT (///50H THETA  ECV  DLRMXV SIGMXV      ECH  DLRMXH SIGMXH )
C
      GO TO (10,20,20),NPOL
C
   10 DO 12 I=1,NPTS
      ID = ID + 1
      WRITE(6,2010) THETA(I,1),EQCL(I,1),DLRMAX(I,1),SIGMAX(I,1),ID
 2010 FORMAT( F6.1,F5.1,1X,2(1X,F6.1), 40X,      7H       P ,I6)
      WRITE(43,1000)THETA(I,1),EQCL(I,1),DLRMAX(I,1),SIGMAX(I,1),ID
 1000 FORMAT( F6.1,4X,3F5.1, 41X,                 7H       P ,I6)
C
   12 CONTINUE
      RETURN
C
C
   20 CONTINUE
      DO 30 I=1,NPTS
      ID = ID + 1
      WRITE(6,2020) THETA(I,1),EQCL(I,1),DLRMAX(I,1),SIGMAX(I,1),
     1                         EQCL(I,2),DLRMAX(I,2),SIGMAX(I,2),ID
 2020 FORMAT( F6.1,F5.1,1X,2(1X,F6.1),2X,F5.1,1X,2(1X,F6.1),18X,7H
     1 ,I6)
      WRITE(43,1010)THETA(I,1),EQCL(I,1),DLRMAX(I,1),SIGMAX(I,1),
     1                         EQCL(I,2),DLRMAX(I,2),SIGMAX(I,2),ID
 1010 FORMAT( F6.1,4X,6F5.1, 26X,                 7H       P ,I6)
C
   30 CONTINUE
C
C
      RETURN
      END
```

SECTION 4

TEST DESCRIPTION

A test problem was run on the GE 635/645 computer for the purposes of debugging computer program DISCRM. A description of the test problem is presented in the following paragraphs.

4.1 INPUT DATA

A complete listing of the input data for the test problem is found in the following pages. The format of the data is described in Section 3.2.1.3.1.

Card 1

DBDOWN	28.0
RLOW	134.5
RHIGH	165.0

Card 2

THTID	Model 6/14 Two Spheres, One Jack
FREQ	9.0
NPOL	1
NBRTGT	1

Card 3

NWDS	450
THOLD	-52.8
IRO	200
THING	1.0
DRANG	0.51

Card 4

POLID	Vert/Vert
NASP	91
THETS	0.0
THETE	90.0
NVOID	0

Card 5

THETA	0.0
ICK	1
NPN	7
EC	3.0
IJPOL	1

Card 6

INPN(1)	1
RR(1)	122.6
SS(1)	-52.8
.	
.	
.	
INPN(NPN=5)	1
RR(NPN=5)	154.9
SS(NPN=5)	-51.8

Card 7

INPN(6)	2
RR(6)	162.6
SS(6)	-28.6
INPN(7)	1
RR(7)	164.7
SS(7)	-46.7

.
.
.

Card N

The input data of importance to DISCRM is:

1. Model 6/14 two spheres, one jack
2. One polarization: Vertical/Vertical
3. Peaks more than 28.0 dB below the maximum peak in the signature are to be ignored.
4. Only peaks between 134.5 and 165.0 inches are to be considered.
5. 91 aspect angles are to be considered: 0 to 90 degrees.

```
28.0        134.2     155.0
 MODEL 6/14     TWO SHAPES, ONE JACK                    9.00     1      1
   450      -52.8        200          1.0        0.51
 VERT/VERT        91    0.0     90.0
        0.0             1              7          3.0             1
 1 122.6-52.8 2 135.9-21.8 1 140.6-40.4 2 148.3-26.1 1 154.9-51.8
 2 162.6-28.6 1 164.7-46.7 2 168.3-42.2 1 171.3-53.2
        1.0             1              7          3.0             1
 1 123.1-52.8 2 136.5-21.6 1 140.0-40.6 2 148.3-25.9 1 154.4-51.8
 2 163.1-29.4 1 164.2-46.8 2 167.8-42.1 1 170.8-53.6
        2.0             1              7          3.0             1
 1 124.1-52.7 2 136.5-21.5 1 140.6-41.5 2 148.8-27.1 1 154.9-52.1
 2 162.6-31.0 1 165.2-46.3 2 167.8-43.1 1 171.3-54.9
        3.0             1              7          3.0             1
 1 123.6-53.1 2 136.5-21.8 1 140.6-42.4 2 148.8-27.4 1 154.9-52.3
 2 161.1-35.6 1 164.7-46.5 2 167.8-43.9 1 170.8-53.5
        4.0             1             11          5.0             1
 1 122.6-54.0 2 126.2-49.5 1 127.7-49.6 2 137.0-22.6 1 140.6-42.6
 2 149.3-29.3 1 154.9-52.7 2 161.1-38.8 1 166.2-47.4 2 168.3-46.1
 1 170.8-53.6
        5.0             1              8          3.0             1
 1 124.1-52.9 2 135.9-22.0 1 141.1-43.5 2 147.7-30.3 1 154.4-53.3
 1 157.0-53.3 2 160.6-45.7 1 170.3-53.9
        6.0             1              8          3.0             1
 1 123.6-53.7 2 136.5-21.8 1 141.1-44.4 2 148.3-31.3 1 154.4-53.9
 1 162.6-53.0 2 167.2-49.6 1 169.8-53.8
        7.0             1             11          4.0             1
 1 125.2-54.0 2 136.5-21.9 1 141.6-45.4 2 148.3-32.5 1 154.4-53.4
 1 156.0-53.9 2 159.5-45.9 1 162.1-53.4 1 166.2-53.5 2 171.3-55.2
 1 173.4-53.8
        8.0             1              7          3.0             1
 1 125.2-52.7 2 136.5-22.4 1 142.1-47.9 2 148.8-34.3 1 154.9-51.6
 2 159.5-41.6 1 169.3-52.9
        9.0             1              9          4.0             1
 1 125.2-52.8 2 136.5-22.1 1 142.6-50.8 2 148.3-35.5 1 154.9-50.3
 2 160.1-38.6 1 162.6-47.5 2 164.2-46.2 1 169.3-53.1
       10.0             1              7          3.0             1
 1 126.2-53.0 2 136.5-22.2 1 142.1-45.6 2 146.2-35.0 1 154.4-48.7
 2 159.5-36.2 1 168.8-53.0
       11.0             1              9          4.0             1
 1 125.7-54.4 2 136.5-21.6 1 141.1-43.8 2 148.3-32.7 1 153.9-48.4
 2 160.1-35.4 1 163.1-48.8 2 164.7-48.0 1 169.8-53.9
       12.0             1              7          3.0             1
 1 127.2-53.2 2 136.5-21.9 1 140.6-42.7 2 148.3-32.6 1 154.4-48.4
 2 161.6-33.5 1 169.3-52.9
       13.0             1              7          3.0             1
 1 127.2-53.0 2 136.5-21.9 1 140.6-41.6 2 148.3-30.0 1 152.9-49.1
 2 161.1-32.3 1 168.3-54.7
       14.0             1              8          3.0             1
 1 126.2-53.1 2 136.5-21.7 1 140.6-41.8 2 147.7-29.0 1 153.9-50.8
 2 160.6-31.3 1 166.2-53.4 1 171.3-53.6
       15.0             1              8          3.0             1
 1 127.2-52.2 2 136.5-21.5 1 140.6-42.5 2 147.7-26.9 1 153.4-52.3
 1 153.9-52.5 2 161.1-29.1 1 166.7-53.3
       16.0             1              8          3.0             1
 1 126.7-52.9 2 137.0-21.8 1 140.6-45.5 2 148.8-25.9 1 152.9-52.8
 1 153.9-53.5 2 162.1-27.5 1 166.2-53.8
       17.0             1              7          3.0             1
 1 127.7-52.3 2 136.5-21.9 1 141.1-45.7 2 148.3-24.4 1 153.9-51.9
 2 161.1-26.7 1 166.7-53.1
```

```
     18.0          1          8        3.0          1
1 126.2-53.0 2 137.0-21.9 1 140.0-43.6 2 148.8-22.9 1 153.4-50.5
2 161.1-25.8 1 166.2-53.2 1 174.4-53.8
     19.0          1         11        4.0          1
1 121.1-53.6 1 125.7-53.1 2 136.5-20.8 1 140.6-42.8 2 147.7-21.4
1 153.4-48.2 2 160.6-24.7 1 166.7-52.9 1 171.3-52.8 2 172.9-49.0
1 175.4-54.7
     20.0          1          9        3.0          1
1 125.2-53.7 2 137.0-21.6 1 140.0-40.4 2 148.3-21.1 1 152.9-44.8
2 161.6-24.4 1 170.3-53.8 1 170.8-53.1 1 180.6-53.4
     21.0          1          8        3.0          1
1 117.5-53.3 2 136.5-21.7 1 140.0-38.5 2 147.2-20.9 1 152.4-43.7
2 160.6-24.6 1 178.0-54.0 1 183.7-53.1
     22.0          1          8        4.0          1
1 117.5-53.3 2 136.5-21.4 1 141.6-34.6 2 147.2-20.3 1 152.4-44.4
2 160.1-24.2 1 167.8-51.4 2 169.3-49.7
     23.0          1         15        6.0          1
1 112.9-53.0 2 114.4-51.7 1 117.0-52.8 1 117.5-53.0 2 120.0-50.8
1 127.2-51.7 2 137.0-21.2 1 142.6-34.9 2 147.7-19.6 1 152.9-46.5
2 160.6-23.3 1 167.8-53.0 1 168.8-53.2 2 173.4-47.4 1 175.4-52.9
     24.0          1         13        5.0          1
1 115.9-53.3 2 136.5-21.8 1 142.1-36.1 2 147.7-20.1 1 152.4-46.6
2 160.6-22.5 1 169.3-52.8 1 170.3-53.1 2 172.4-47.5 1 177.0-52.9
1 180.1-54.1 2 182.6-50.9 1 185.2-53.6
     25.0          1         15        6.0          1
1 113.4-53.7 2 121.1-51.6 1 123.1-52.3 2 124.7-50.9 1 127.2-51.9
2 137.5-21.5 1 141.6-35.4 2 148.3-18.9 1 152.9-47.3 2 161.1-21.8
1 171.9-53.1 1 173.4-53.1 1 180.1-53.4 2 183.7-50.0 1 186.2-54.1
     26.0          1         12        4.0          1
1 111.8-52.8 2 137.5-21.3 1 140.0-41.5 2 147.7-19.2 1 152.9-47.5
2 160.6-21.6 1 175.4-53.3 1 180.6-53.3 2 183.1-50.3 1 186.2-52.8
1 192.4-52.9 1 194.4-53.1
     27.0          1         19        8.0          1
1 112.3-52.8 1 119.0-52.7 1 119.5-53.0 2 122.1-50.4 2 137.5-21.1
1 139.5-41.4 2 147.7-18.6 1 151.3-43.4 2 160.6-22.2 2 171.3-48.7
1 174.4-54.4 1 176.5-52.9 2 178.0-50.3 1 180.6-53.7 1 181.6-52.9
2 183.7-50.0 1 187.2-52.6 2 189.8-51.3 1 192.4-53.3
     28.0          1         14        6.0          1
1 117.5-53.0 2 123.6-50.9 1 126.2-51.9 2 138.0-20.8 1 141.6-33.1
2 148.3-18.4 1 151.8-41.4 2 160.6-22.2 1 176.0-52.9 2 178.0-50.3
1 182.1-53.0 1 182.6-53.0 2 184.2-50.4 1 186.7-53.1
     29.0          1         14        6.0          1
1 114.4-52.9 2 120.0-50.6 1 123.1-51.7 2 137.5-21.2 1 142.1-33.6
2 147.7-19.8 1 152.4-41.1 2 160.1-23.2 1 167.2-50.5 2 170.3-49.0
1 173.4-53.0 1 181.6-53.0 2 184.7-51.3 1 186.7-53.1
     30.0          1         14        6.0          1
1 111.8-53.6 1 115.4-53.5 2 120.6-51.2 1 123.6-52.8 2 126.2-51.4
1 127.7-52.3 2 137.5-21.5 1 141.6-33.3 2 147.7-20.2 1 152.4-43.6
2 160.1-24.8 1 168.8-53.9 2 171.3-48.9 1 174.4-53.4
     31.0          1         11        4.0          1
1 117.0-53.5 2 120.6-51.5 1 122.6-52.2 2 137.5-21.0 1 142.1-34.3
2 147.7-21.8 1 151.8-44.3 2 160.1-24.7 1 166.2-53.6 1 168.8-53.1
1 172.9-53.0
     32.0          1         11        4.0          1
1 123.6-53.3 2 126.2-51.7 1 128.2-52.1 2 137.0-21.2 1 140.6-40.8
2 147.2-22.3 1 152.4-47.5 2 159.0-24.6 1 164.7-52.9 1 170.3-53.6
1 184.7-53.6
     33.0          1         13        5.0          1
1 119.0-53.8 2 120.6-52.4 1 123.1-53.2 1 125.7-53.1 2 137.5-21.1
1 140.6-40.9 2 147.7-22.5 1 151.8-45.7 2 159.5-25.7 1 166.7-52.9
```

```
1 169.3-52.8 2 176.0-54.7 1 178.0-53.5
     34.0          1          6        3.0          1
1 126.2-52.9 2 138.0-21.4 2 148.3-21.9 1 151.8-41.5 2 159.5-26.2
1 166.7-53.3
     35.0          1         10        5.0          1
1 119.5-53.1 2 126.2-50.6 1 127.7-51.1 2 138.0-20.9 1 141.6-32.8
2 147.7-22.0 1 152.4-40.8 2 159.0-26.0 2 170.3-49.0 1 173.4-53.6
     36.0          1         12        5.0          1
1 117.5-53.1 2 124.7-51.0 1 126.7-51.7 2 138.0-20.6 1 142.1-32.8
2 147.7-21.2 1 151.8-43.7 2 159.0-25.7 1 165.7-53.3 1 168.3-54.6
2 170.3-49.8 1 172.4-53.1
     37.0          1         13        6.0          1
2 121.1-51.7 1 123.1-52.6 2 125.2-51.2 1 127.7-52.5 2 138.5-20.8
1 142.1-32.8 2 148.3-20.5 1 151.8-45.4 2 160.1-25.2 1 166.2-53.0
2 167.8-50.4 1 169.8-54.1 1 175.4-53.0
     38.0          1         17        6.0          1
1 115.9-52.9 1 122.1-52.7 2 138.5-20.8 1 142.1-36.5 2 147.7-20.3
1 151.8-45.3 2 159.0-24.0 1 163.6-49.9 2 165.2-48.3 1 169.3-51.5
1 173.9-53.7 1 181.6-53.3 2 183.7-51.6 1 186.2-52.9 1 187.2-53.1
2 189.8-50.0 1 192.9-53.1
     39.0          1         11        4.0          1
1 114.4-53.1 1 121.6-53.0 2 125.2-50.5 2 139.0-20.8 2 148.8-19.3
1 150.8-38.6 2 159.5-22.5 1 168.3-51.3 1 171.9-53.4 1 177.0-53.1
1 182.6-51.9
     40.0          1         12        5.0          1
1 109.3-52.9 2 125.7-50.4 1 128.8-51.3 2 139.0-20.4 1 142.6-31.9
2 148.3-19.2 1 151.3-37.4 2 159.0-22.6 1 167.8-51.2 2 170.3-47.5
1 172.9-53.4 1 179.0-53.5
     41.0          1         15        6.0          1
1 112.3-53.1 2 124.7-50.3 1 129.3-50.2 2 139.0-20.3 1 142.6-31.3
2 147.7-19.2 1 151.8-40.6 2 158.5-23.4 1 166.2-53.0 1 168.3-54.1
2 169.8-49.9 1 171.9-52.7 2 173.9-49.0 1 177.0-52.9 1 182.1-53.0
     42.0          1         11        6.0          1
2 139.5-21.1 2 148.3-20.8 1 150.8-42.4 2 159.0-23.3 1 162.6-51.1
2 164.2-48.2 1 166.2-51.5 2 167.8-49.2 1 170.3-53.0 1 181.6-53.7
2 194.4-49.7
     43.0          1         12        5.0          1
1 121.6-51.8 2 139.5-20.7 2 148.3-20.8 1 151.3-40.6 2 158.5-23.4
1 162.1-47.3 2 164.7-46.7 1 173.9-52.7 2 176.0-50.5 1 178.5-53.1
1 182.6-52.8 1 188.8-52.6
     44.0          1         10        4.0          1
1 113.9-54.4 1 123.6-52.7 2 125.2-50.8 1 127.7-52.5 2 138.5-21.0
1 142.6-32.5 2 147.2-21.2 1 152.9-34.3 2 158.0-23.4 1 168.3-51.8
     45.0          1         10        4.0          1
1 109.8-53.5 1 129.3-52.4 2 139.5-20.5 1 143.6-29.1 2 147.7-20.5
1 152.9-36.6 2 158.0-24.7 1 165.7-52.0 2 169.3-48.7 1 178.0-54.5
     46.0          1         13        6.0          1
2 139.0-20.8 1 143.6-31.4 2 147.2-20.6 1 150.3-42.4 2 157.5-24.7
1 161.6-50.9 2 163.1-47.1 1 165.2-52.6 1 182.6-53.5 2 184.7-51.6
1 186.7-52.7 1 191.9-52.7 2 194.4-50.7
     47.0          1         17        7.0          1
1 115.4-53.9 2 117.0-51.8 1 119.5-53.3 2 121.1-51.9 1 123.6-53.5
2 139.5-20.9 2 147.7-20.3 1 150.8-42.6 2 157.5-24.4 1 161.6-50.9
2 163.6-46.7 1 167.2-52.5 1 173.4-53.1 1 184.2-53.0 1 187.8-53.2
2 190.3-51.6 1 193.4-53.3
     48.0          1         12        6.0          1
1 116.5-53.9 2 121.1-51.8 1 122.6-52.5 2 125.2-51.7 2 140.0-21.6
1 143.6-31.9 2 148.3-19.3 1 151.9-33.1 2 157.5-24.1 1 162.1-51.2
2 163.6-46.0 1 167.2-52.3
     49.0          1         12        6.0          1
```

```
1 112.3-53.3 2 114.4-51.3 2 127.2-50.1 1 128.8-51.3 2 140.0-20.7
1 143.1-27.7 2 147.7-18.4 1 152.9-33.5 2 157.5-23.5 1 164.2-52.8
2 168.3-49.2 1 176.5-53.2
     50.0          1          17         7.0          1
2 118.5-51.1 1 121.1-52.7 2 122.6-50.9 1 125.2-51.8 2 139.0-20.4
1 143.1-28.9 2 147.2-19.1 1 150.3-40.1 2 156.5-23.2 1 161.1-50.0
2 163.1-45.7 1 165.7-53.0 1 169.3-53.9 1 175.4-53.7 1 186.7-53.7
1 189.3-53.2 2 193.9-50.0
     51.0          1          17         7.0          1
1 115.4-53.3 2 118.0-52.2 1 119.5-53.1 2 140.0-20.9 2 147.2-20.3
1 151.8-36.7 2 157.0-23.1 1 161.1-51.3 2 163.1-48.1 1 166.7-51.6
1 173.4-53.7 2 175.4-51.5 1 178.0-53.5 1 181.6-53.2 1 188.8-53.5
2 190.3-50.8 1 194.9-53.3
     52.0          1          11         5.0          1
1 116.5-52.9 2 124.7-50.7 2 140.6-21.4 1 143.6-30.5 2 148.3-20.4
1 152.4-31.8 2 157.0-23.3 1 166.7-50.2 2 168.3-49.1 1 170.3-52.5
1 178.5-53.1
     53.0          1          10         3.0          1
1 115.9-52.4 1 119.5-51.7 1 129.8-51.7 2 140.0-20.9 1 143.6-27.0
2 147.2-20.3 1 152.9-32.6 2 156.5-23.7 1 162.6-52.8 1 178.0-53.9
     54.0          1          17         7.0          1
1 115.4-53.2 2 124.7-50.8 1 129.3-51.9 2 141.1-21.0 1 144.2-28.1
2 147.2-21.1 1 149.8-43.5 2 156.5-24.3 2 162.6-47.1 1 165.2-53.0
1 168.8-53.3 1 176.0-53.9 1 182.6-53.5 2 186.2-53.5 1 188.3-53.6
1 188.8-53.5 2 193.4-49.5
     55.0          1          11         5.0          1
2 121.1-51.5 1 123.6-52.5 2 140.0-20.6 2 147.2-20.4 1 149.3-40.1
2 156.0-24.3 2 167.8-50.2 1 169.8-53.4 1 179.5-53.2 2 182.6-53.3
1 184.7-53.7
     56.0          1          12         5.0          1
1 118.0-53.2 2 121.1-51.5 1 123.6-52.3 2 127.2-51.2 1 129.8-52.3
2 141.1-21.1 1 144.2-27.9 2 148.3-19.9 1 152.4-30.5 2 156.5-23.8
1 170.3-53.0 1 171.9-52.8
     57.0          1          17         7.0          1
1 112.3-53.1 2 116.5-51.3 2 124.1-50.5 1 126.7-51.8 2 141.1-20.9
1 144.2-24.9 2 147.2-20.1 1 152.4-31.9 2 155.4-25.4 1 164.7-53.0
1 168.8-54.4 2 170.3-50.0 1 172.4-53.4 1 174.4-53.7 2 176.0-50.6
1 179.5-53.7 1 194.4-52.3
     58.0          1          16         7.0          1
1 115.4-52.9 2 119.5-51.4 2 129.8-50.5 1 131.3-51.9 2 141.6-20.6
1 144.7-26.4 2 148.3-19.2 2 156.5-23.6 1 160.1-50.9 2 161.6-46.2
1 166.2-53.2 1 166.7-53.1 1 181.6-52.9 1 186.2-53.4 1 186.7-53.0
2 191.3-48.2
     59.0          1          14         6.0          1
1 114.4-53.2 2 115.9-52.3 1 118.0-52.8 1 118.5-52.9 2 141.6-21.3
2 147.7-19.9 1 151.3-29.9 2 155.4-23.4 1 159.5-50.6 2 161.1-47.9
1 165.7-52.6 1 176.5-53.3 2 179.0-52.0 1 181.6-53.0
     60.0          1          14         6.0          1
1 112.3-53.4 1 119.5-52.5 2 122.1-50.5 1 127.7-51.1 2 142.1-20.5
1 144.7-24.3 2 148.3-19.1 1 151.8-27.4 2 156.0-22.8 1 162.1-50.9
2 166.2-48.9 1 171.9-52.7 2 173.4-50.6 1 175.4-52.7
     61.0          1          17         7.0          1
1 111.8-54.0 2 124.7-50.8 2 142.1-20.6 1 144.7-23.7 2 147.7-20.5
1 150.8-33.2 2 154.9-23.8 1 160.1-49.5 2 161.6-47.3 1 164.2-52.5
1 167.8-53.2 1 175.4-53.7 2 177.5-50.9 1 179.5-53.2 1 182.6-53.4
1 187.8-53.0 2 191.9-49.8
     62.0          1          9          4.0          1
1 116.5-52.9 2 120.6-51.0 1 122.1-51.5 2 142.1-21.4 1 145.2-28.8
2 148.3-20.9 2 155.4-24.3 1 166.2-52.6 1 177.5-53.1
     63.0          1          12         5.0          1
```

1 113.4-53.5 1 117.9-52.8 2 142.6-21.7 1 144.7-27.0 2 147.7-20.1
1 151.3-29.2 2 155.4-23.3 1 159.5-49.2 2 161.1-46.7 1 162.6-50.4
2 164.7-49.4 1 168.8-53.8
64.0 1 19 7.0 1
1 112.3-53.0 2 115.4-50.6 1 117.0-52.3 2 123.6-50.3 2 142.6-20.0
1 145.2-22.1 2 147.2-18.7 1 151.3-28.3 2 154.4-25.1 1 163.1-53.1
1 163.6-53.4 2 165.7-48.7 1 171.3-53.2 1 173.4-53.1 2 177.0-49.8
1 180.6-52.5 1 182.6-53.4 1 188.8-52.9 1 193.9-53.1
65.0 1 17 6.0 1
1 119.5-53.7 1 120.0-53.3 1 127.7-52.7 1 131.8-53.6 2 142.6-20.4
1 144.7-23.5 2 147.7-20.2 1 150.8-32.6 2 154.4-25.0 1 165.2-53.4
1 177.0-54.7 2 179.5-50.7 1 182.1-53.1 2 184.7-51.4 1 188.3-53.3
1 189.3-53.6 2 191.9-50.8
66.0 1 10 5.0 1
1 125.2-53.0 2 128.2-50.8 2 143.1-21.8 1 145.2-31.1 2 148.3-19.8
1 151.3-26.8 2 154.4-22.7 1 158.0-50.9 2 159.5-47.4 1 164.2-53.3
67.0 1 11 5.0 1
1 111.8-53.0 2 148.3-18.4 1 151.8-25.5 2 154.4-22.8 1 156.0-43.5
2 157.5-42.1 1 162.6-51.5 2 164.7-46.6 1 172.4-53.4 2 176.0-51.5
1 178.0-53.1
68.0 1 17 7.0 1
1 113.9-53.4 1 118.0-52.6 2 129.3-50.5 1 132.4-51.3 2 144.2-19.3
1 151.8-33.2 2 154.9-24.2 1 160.6-50.8 2 162.1-47.1 1 164.2-52.6
1 177.5-52.8 2 179.5-51.0 1 181.6-52.5 2 184.2-50.2 1 187.8-52.5
2 189.8-50.4 1 193.4-51.3
69.0 1 11 5.0 1
1 117.5-52.7 2 120.6-50.8 2 142.1-22.3 1 144.7-30.4 2 147.2-21.4
1 149.8-29.7 2 152.4-23.4 1 161.1-49.2 2 162.6-48.0 1 164.7-52.6
1 182.1-52.6
70.0 1 11 5.0 1
1 113.9-52.9 2 130.8-50.0 1 132.4-50.5 2 144.2-20.4 1 145.7-21.5
2 147.2-19.4 1 151.8-25.1 2 153.9-22.9 1 163.1-50.6 2 165.7-46.2
1 172.4-53.1
71.0 1 14 6.0 1
1 117.0-53.4 2 120.0-50.9 1 121.6-51.9 2 123.1-51.0 2 143.6-17.8
1 150.8-25.9 2 152.4-24.0 1 165.7-53.7 1 169.3-53.1 1 177.0-53.5
2 183.7-49.9 1 188.3-51.5 2 189.8-50.4 1 192.4-52.4
72.0 1 13 6.0 1
1 115.4-53.1 2 130.3-50.1 2 143.6-22.8 1 145.2-25.7 2 147.7-21.9
1 150.3-30.8 2 152.9-24.7 2 161.6-47.9 1 165.7-53.1 1 169.3-52.0
1 178.3-53.4 2 182.4-53.2 1 194.4-53.4
73.0 1 13 5.0 1
1 113.9-52.9 1 119.5-53.1 2 144.7-21.1 1 146.2-23.0 2 148.3-19.1
1 150.8-22.1 2 152.9-21.6 1 156.0-47.7 2 158.5-42.8 1 162.1-52.2
2 164.7-48.5 1 167.8-53.0 1 171.3-53.7
74.0 1 14 6.0 1
1 113.9-53.9 2 115.9-52.4 1 117.5-52.7 2 122.1-51.1 1 126.2-51.6
2 145.7-17.1 1 151.3-25.7 2 152.9-25.7 1 160.6-52.6 2 163.6-50.6
1 165.2-53.3 1 179.0-53.6 2 184.2-50.6 1 186.2-52.7
75.0 1 11 4.0 1
1 118.5-52.9 2 146.7-21.5 1 149.8-31.1 2 152.4-22.2 1 160.1-51.3
2 161.6-46.8 1 166.2-53.7 1 167.2-53.9 1 177.5-53.6 2 180.1-50.9
1 182.1-53.3
75.0 1 7 3.0 1
1 119.5-52.9 2 148.3-20.9 1 150.8-23.7 2 152.4-23.1 1 161.6-50.6
2 164.2-48.8 1 166.2-53.1
77.0 1 14 5.0 1
1 114.4-52.7 1 126.2-51.5 2 130.8-49.3 1 133.9-50.5 2 147.2-16.5
1 160.6-52.5 2 163.1-48.3 1 168.3-52.5 1 170.8-52.8 1 175.4-53.0
2 182.1-48.3 1 185.7-51.2 2 186.3-49.7 1 191.9-52.6

```
     78.0          1          8        3.0          1
1 120.0-53.4 2 146.2-13.9 2 152.4-26.7 1 159.0-50.9 2 161.1-49.2
1 164.7-53.6 1 167.2-53.2 1 183.1-53.4
     79.0          1          8        3.0          1
1 113.9-52.9 2 121.6-50.6 2 144.7-26.5 1 146.2-29.1 2 148.3-21.7
1 159.0-47.7 1 167.8-52.8 1 171.3-52.9
     80.0          1         15        6.0          1
1 111.8-53.6 2 122.6-49.3 1 129.3-50.8 2 132.4-49.6 1 135.9-49.9
2 146.7-15.7 1 160.6-50.7 2 162.6-48.7 1 172.4-53.3 1 176.5-53.7
2 183.7-49.0 1 186.2-52.3 2 188.3-52.1 1 190.3-53.3 1 192.9-53.2
     81.0          1         15        6.0          1
1 120.6-53.1 2 123.6-53.8 1 125.7-53.3 2 131.3-51.2 1 134.4-52.8
2 146.7-18.1 1 149.8-29.5 2 151.8-25.3 1 155.4-48.9 2 157.5-45.9
1 164.7-53.2 1 166.7-55.4 1 179.5-53.1 2 182.1-51.3 1 184.7-53.8
     82.0          1          9        4.0          1
1 119.5-53.1 2 128.2-51.0 1 131.3-52.6 2 145.2-30.2 1 146.7-34.5
2 151.3-23.7 1 158.0-51.5 2 162.1-49.2 1 164.7-52.8
     83.0          1          9        4.0          1
1 108.2-52.9 2 127.2-48.3 2 147.2-15.6 1 159.0-49.7 2 161.6-48.0
1 177.5-52.3 2 183.7-47.4 1 189.3-52.8 1 194.4-52.4
     84.0          1          6        2.0          1
1 120.0-53.0 2 146.7-17.3 1 157.5-46.5 2 159.0-45.8 1 167.8-53.1
1 181.1-53.4
     85.0          1          6        2.0          1
1 132.9-53.8 1 137.5-52.8 2 150.8-23.6 1 153.4-44.4 2 154.9-43.3
1 158.0-52.4
     86.0          1         13        6.0          1
1 110.3-53.5 2 123.6-48.3 2 147.2-15.9 1 159.0-48.4 2 161.6-46.7
1 164.7-50.4 2 166.2-48.7 1 168.3-51.2 2 169.8-50.1 1 173.4-53.0
1 178.0-52.7 2 183.1-48.2 1 188.3-52.6
     87.0          1         17        8.0          1
1 108.2-53.3 1 111.8-53.3 2 114.4-51.8 1 117.5-52.9 2 122.6-49.7
1 126.2-51.4 2 128.8-50.1 2 134.9-49.6 1 136.5-50.5 2 147.7-17.7
1 156.5-47.4 2 158.5-44.1 1 166.2-53.2 2 168.3-51.0 1 170.3-53.1
1 179.5-53.1 2 194.4-55.3
     88.0          1          7        3.0          1
1 139.5-53.5 2 149.8-23.8 1 152.9-46.0 2 154.9-44.5 1 157.0-50.3
2 159.0-48.7 1 162.6-53.8
     89.0          1         12        4.0          1
1 112.3-52.8 1 134.4-50.0 2 149.8-16.8 1 156.0-49.0 2 160.1-47.3
1 168.3-51.8 2 169.8-50.1 1 172.9-52.9 1 177.0-53.5 2 184.2-47.6
1 188.8-53.8 1 193.9-52.7
     90.0          1         14        7.0          1
1 109.3-53.4 2 127.7-48.5 1 129.3-49.0 2 130.8-48.0 2 147.2-16.1
1 157.0-46.3 2 158.5-43.9 1 160.6-49.2 2 162.6-48.0 1 166.2-51.5
2 167.8-50.3 1 171.3-52.9 1 179.0-53.0 2 194.4-55.5
```

4.2 OUTPUT DATA

The output for the sample problem may be found in the following pages. The first part of the output is a listing of the input data. The second part is a listing of the resulting discriminants calculated from the input data. Only one polarization was examined (Vert/Vert). The listing contains the discriminants (1) equivalence class (ECV), (2) maximum separation between significant peaks in the signature (DLRMXV), and (3) maximum target radar cross section in the signature (SIGMXV) for each aspect angle (THETA) for Vert/Vert polarization. If two polarizations were examined the discriminants formed for the second polarization would have been listed in the appropriate columns.

```
   SNUMB = 10251, ACTIVITY # = 02, REPORT CODE = 06, RECORD COUNT = 00451

MODEL 6/14     TWO SPHERES, ONE JACK                    9.00     1      1        P 10003
  450      -52.6          200          1.0          0.51                          P 10004
CONSIDER ONLY PEAKS LESS THAN 28.0 DB DOWN AND BETWEEN  134.5  AND     165.0  IN
VERT/VERT       91     0.     90.0    0                                          P 10005
       0.              1              7              3.0              1
1 122.6-52.8 2 135.9-21.8 1 140.6-40.4 2 148.3-26.1 1 154.9-51.8
2 162.6-28.6 1 164.7-46.7
       1.0             1              7              3.0              1
1 123.1-52.8 2 136.5-21.6 1 140.0-40.6 2 148.3-25.9 1 154.4-51.8
2 163.1-29.4 1 164.2-46.8
       2.0             1              7              3.0              1
1 124.1-52.7 2 136.5-21.5 1 140.6-41.5 2 148.8-27.1 1 154.9-52.1
2 162.6-31.0 1 165.2-46.3
       3.0             1              7              3.0              1
1 123.6-53.1 2 136.5-21.8 1 140.6-42.4 2 148.8-27.4 1 154.9-52.3
2 161.1-35.6 1 164.7-46.5
       4.0             1             11              5.0              1
1 122.6-54.0 2 126.2-49.5 1 127.7-49.6 2 137.0-22.6 1 140.6-42.6
2 149.3-29.3 1 154.9-52.7 2 161.1-38.8 1 166.2-47.4 2 168.3-46.1
1 170.8-53.6
       5.0             1              8              3.0              1
1 124.1-52.9 2 135.9-22.0 1 141.1-43.5 2 147.7-30.3 1 154.4-53.3
1 157.0-53.3 2 160.6-45.7 1 170.3-53.9
       6.0             1              8              3.0              1
1 123.6-53.7 2 136.5-21.8 1 141.1-44.4 2 148.3-31.3 1 154.4-53.9
1 162.6-53.0 2 167.2-49.6 1 169.3-53.8
       7.0             1             11              4.0              1
1 125.2-54.0 2 136.5-21.9 1 141.6-45.4 2 148.3-32.5 1 154.4-53.4
1 156.0-53.9 2 159.5-45.9 1 162.1-53.4 1 166.2-53.5 2 171.3-55.2
1 173.4-53.8
       8.0             1              7              3.0              1
1 125.2-52.7 2 136.5-22.4 1 142.1-47.9 2 148.8-34.3 1 154.9-51.6
2 159.5-41.6 1 169.3-52.9
       9.0             1              9              4.0              1
1 125.2-52.8 2 136.5-22.1 1 142.6-50.8 2 148.3-35.5 1 154.9-50.3
2 160.1-38.6 1 162.6-47.5 2 164.2-46.2 1 169.3-53.1
      10.0             1              7              3.0              1
1 126.2-53.0 2 136.5-22.2 1 142.1-45.6 2 146.2-35.0 1 154.4-48.7
2 159.5-36.2 1 168.8-53.0
      11.0             1              9              4.0              1
1 125.7-54.4 2 136.5-21.6 1 141.1-43.8 2 148.3-32.7 1 153.9-48.4
2 160.1-35.4 1 163.1-48.3 2 164.7-48.0 1 169.8-53.9
      12.0             1              7              3.0              1
1 127.2-53.2 2 136.5-21.9 1 140.6-42.7 2 148.3-32.6 1 154.4-48.4
2 161.6-33.5 1 169.3-52.9
      13.0             1              7              3.0              1
1 127.2-53.0 2 136.5-21.9 1 140.6-41.6 2 148.3-30.0 1 152.9-49.1
2 161.1-32.3 1 168.3-54.7
      14.0             1              8              3.0              1
1 126.2-53.1 2 136.5-21.7 1 140.6-41.8 2 147.7-29.0 1 153.9-50.8
2 160.6-31.3 1 166.2-53.4 1 171.3-53.6
      15.0             1              8              3.0              1
1 127.2-52.2 2 136.5-21.5 1 140.6-42.5 2 147.7-26.9 1 153.4-52.3
1 153.9-52.5 2 161.1-29.1 1 166.7-53.3
      16.0             1              8              3.0              1
1 126.7-52.9 2 137.0-21.8 1 140.6-45.5 2 148.8-29.9 1 152.9-52.8
1 153.9-53.5 2 162.1-27.5 1 166.2-53.8
      17.0             1              7              3.0              1
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1 127,7-52,3 2 136,5-21,9 1 141,1-45,7 2 148,3-24,4 1 153,9-51,9
2 161,1-26,7 1 166,7-53,1
     18,0          1          8          3,0          1
1 126,2-53,0 2 137,0-21,9 1 140,0-43,6 2 148,8-22,9 1 153,4-50,5
2 161,1-25,8 1 166,2-53,2 1 174,4-53,8
     19,0          1         11          4,0          1
1 121,1-53,6 1 125,7-53,1 2 136,5-20,8 1 140,6-42,8 2 147,7-21,4
1 153,4-48,2 2 160,6-24,7 1 166,7-52,9 1 171,3-52,8 2 172,9-49,0
1 175,4-54,7
     20,0          1          9          3,0          1
1 125,2-53,7 2 137,0-21,6 1 140,0-40,4 2 148,3-21,1 1 152,9-44,8
2 161,6-24,4 1 170,3-53,8 1 170,8-53,1 1 180,6-53,4
     21,0          1          8          3,0          1
1 117,5-53,3 2 136,5-21,7 1 140,0-38,5 2 147,2-20,9 1 152,4-43,7
2 160,6-24,6 1 178,0-54,0 1 185,7-53,1
     22,0          1          8          4,0          1
1 117,5-53,3 2 136,5-21,4 1 141,6-34,6 2 147,2-20,3 1 152,4-44,4
2 160,1-24,2 1 167,8-51,4 2 169,3-49,7
     23,0          1         15          6,0          1
1 112,9-53,0 2 114,4-51,7 1 117,0-52,8 1 117,5-53,0 2 120,0-50,8
1 127,2-51,7 2 137,0-21,2 1 142,6-34,9 2 147,7-19,6 1 152,9-46,5
2 160,6-23,3 1 167,8-53,0 1 168,8-53,2 2 173,4-47,4 1 175,4-52,9
     24,0          1         13          5,0          1
1 115,9-53,3 2 136,5-21,8 1 142,1-36,1 2 147,7-20,1 1 152,4-46,6
2 160,6-22,5 1 169,3-52,8 1 170,3-53,1 2 172,4-47,5 1 177,0-52,9
1 180,1-54,1 2 182,6-50,9 1 185,2-53,6
     25,0          1         15          6,0          1
1 113,4-53,7 2 121,1-51,6 1 123,1-52,3 2 124,7-50,9 1 127,2-51,9
2 137,5-21,5 1 141,6-35,4 2 146,3-18,9 1 152,9-47,3 2 161,1-21,8
1 171,9-53,1 1 173,4-53,1 1 180,1-53,4 2 183,7-50,0 1 186,2-54,1
     26,0          1         12          4,0          1
1 111,8-52,8 2 137,5-21,3 1 140,0-41,5 2 147,7-19,2 1 152,9-47,5
2 160,6-21,6 1 175,4-53,3 1 180,6-53,3 2 183,1-50,3 1 186,2-52,8
1 192,4-52,9 1 194,4-53,1
     27,0          1         19          8,0          1
1 112,3-52,8 1 119,0-52,7 1 119,5-53,0 2 122,1-50,4 2 137,5-21,1
1 139,5-41,4 2 147,7-18,6 1 151,3-43,4 2 160,6-22,2 2 171,3-48,7
1 174,4-54,4 1 176,5-52,9 2 178,0-50,3 1 180,6-53,7 1 181,6-52,9
2 183,7-50,0 1 187,2-52,6 2 189,8-51,3 1 192,4-53,3
     28,0          1         14          6,0          1
1 117,5-53,0 2 123,6-50,9 1 126,2-51,9 2 138,0-20,6 1 141,6-33,1
2 148,3-18,4 1 151,8-41,4 2 160,6-22,2 1 176,0-52,9 2 178,0-50,3
1 182,1-53,0 1 182,6-53,0 2 184,2-50,4 1 186,7-53,1
     29,0          1         14          6,0          1
1 114,4-52,9 2 120,0-50,6 1 123,1-51,7 2 137,5-21,2 1 142,1-33,6
2 147,7-19,8 1 152,4-41,1 2 160,1-23,2 1 167,2-50,5 2 170,3-49,0
1 173,4-53,0 1 181,6-53,0 2 184,7-51,3 1 186,7-53,1
     30,0          1         14          6,0          1
1 111,8-53,6 1 115,4-53,5 2 120,6-51,2 1 123,6-52,8 2 125,2-51,4
1 127,7-52,3 2 137,5-21,5 1 141,6-33,3 2 147,7-20,2 1 152,4-43,6
2 160,1-24,8 1 168,8-53,9 2 171,3-48,9 1 174,4-53,4
     31,0          1         11          4,0          1
1 117,0-53,5 2 120,6-51,5 1 122,6-52,2 2 137,5-21,0 1 142,1-34,3
2 147,7-21,8 1 151,8-44,3 2 160,1-24,7 1 166,2-53,6 1 166,3-53,1
1 172,9-53,0
     32,0          1         11          4,0          1
1 123,6-53,3 2 126,2-51,7 1 128,2-52,1 2 137,0-21,2 1 140,6-40,8
2 147,2-22,3 1 152,4-47,5 2 159,0-24,6 1 164,7-52,9 1 170,3-53,6
1 184,7-53,6
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1 119.0-53.8 2 120.6-52.4 1 123.1-53.2 1 125.7-53.1 2 137.5-21.1
1 140.6-40.9 2 147.7-22.5 1 151.8-45.7 2 159.5-25.7 1 166.7-52.9
1 169.3-52.8 2 176.0-54.7 1 176.0-53.5
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1 166.7-53.3
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2 147.7-22.0 1 152.4-40.8 2 159.0-26.0 2 170.3-49.0 1 173.4-53.6
     36.0          1          12          5.0          1
1 117.5-53.1 2 124.7-51.0 1 126.7-51.7 2 138.0-20.6 1 142.1-32.8
2 147.7-21.2 1 151.8-43.7 2 159.0-25.7 1 165.7-53.3 1 168.3-54.6
2 170.3-49.8 1 172.4-53.1
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2 121.1-51.7 1 123.1-52.6 2 125.2-51.2 1 127.7-52.5 2 138.5-20.8
1 142.1-32.8 2 148.3-20.5 1 151.8-45.4 2 160.1-25.2 1 166.2-53.0
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2 189.8-50.0 1 192.9-53.1
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1 188,8-53,5 2 193,4-49,5
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2 191,3-48,2
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     60,0          1          14         5,0          1
1 112,3-53,4 1 119,5-52,5 2 122,1-50,5 1 127,7-51,1 2 142,1-20,5
1 144,7-24,3 2 148,3-19,1 1 151,5-27,4 2 156,0-22,8 1 162,1-50,9
2 166,2-48,9 1 171,9-52,7 2 173,4-50,6 1 175,4-52,7
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1 150,8-33,2 2 154,9-23,5 1 160,1-49,5 2 161,6-47,3 1 164,2-52,5
1 167,8-53,2 1 175,4-53,7 2 177,5-50,9 1 179,5-53,2 1 182,6-53,3
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AD-A033 709 PRC INFORMATION SCIENCES CO ROME N Y F/G 15/3
SPACE SURVEILLANCE SOFTWARE SUPPORT. VOLUME III. RADAR SIGNATUR--ETC(U)
OCT 76 P R CONTI F30602-75-C-0167
UNCLASSIFIED RADC-TR-76-261-VOL-3 NL

2 OF 3
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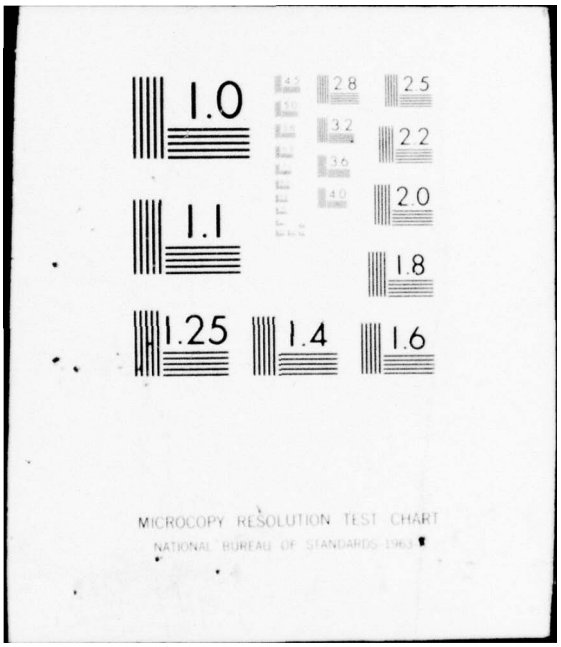
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963

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2 148,3-20,9 2 155,4-24.3 1 166.2-52,6 1 177,5-53.1
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1 113,4-53,5 1 117,5-52,8 2 142,6-21,7 1 144,7-27.0 2 147.7-20,1
1 151,3-29,2 2 155,4-23,3 1 159,5-49,2 2 161,1-46,7 1 162,6-50,4
2 164,7-49,4 1 168,8-53,8
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1 112,3-53,0 2 115,4-50,6 1 117,0-52,3 2 123,6-50,3 2 142,6-20,0
1 145,2-22,1 2 147,2-19,7 1 151,3-28,3 2 154,4-25,1 1 165,1-53,1
1 163,6-53,4 2 165,7-48,7 1 171,3-53,2 1 173,4-53,1 2 177,0-49,8
1 180,6-52,5 1 182,6-53,4 1 188,8-52,9 1 193,9-53,1
     65.0          1         17          6,0          1
1 119,5-53,7 1 120,0-53,3 1 127,7-52,7 1 131,8-53,6 2 142,6-20,4
1 144,7-23,5 2 147,7-20,2 1 150,8-32,6 2 154,4-25,0 1 165,2-53,4
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1 189,3-53,6 2 191,9-50,8
     66.0          1         10          5.0          1
1 125,2-53,0 2 126,2-50,8 2 143,1-21,8 1 145,2-31,1 2 148,3-19,8
1 151,3-26,8 2 154,4-22,7 1 158,0-50,9 2 159,5-47,4 1 164,2-53,3
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1 111,8-53,0 2 148,3-18,4 1 151,8-25,5 2 154,4-22,8 1 156,0-43,5
2 157,5-42,1 1 162,6-51,5 2 164,7-46,6 1 172,4-53,4 2 176,0-51,5
1 178,0-53,1
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1 151,8-33,2 2 154,9-24,2 1 160,6-50,8 2 162,1-47,1 1 164,2-52,6
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2 189,8-50,4 1 193,4-51,3
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1 149,8-29,7 2 152,4-23,4 1 161,1-49,2 2 162,6-48,0 1 164,7-52,6
1 182,1-52,6
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2 147,2-19,4 1 151,8-25,1 2 153,9-22,9 1 163,1-50,6 2 165,7-46,2
1 172,4-53,1
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1 150,8-25,9 2 152,4-24,0 1 165,7-53,7 1 169,3-53,1 1 177,0-53,5
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1 178,5-53,4 2 192,4-55,2 1 194,4-53,4
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1 150,8-22,1 2 152,9-21,6 1 156,0-47,7 2 158,5-42,8 1 162,1-52,2
2 164,7-48,5 1 167,8-53,0 1 171,3-53,7
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1 182,1-53,3
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2 164,2-48,8 1 166,2-53,1
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1 164,7-53,6 1 167,2-53,2 1 183,1-53,4
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1 159,0-47,7 1 167,8-52,8 1 171,3-52,9
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2 159,0-48,7 1 162,6-53,8
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1 188,8-53,8 1 193,9-52,7
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39,0	3,0	20,5	-19,3
40,0	3,0	20,0	-19,2
41,0	3,0	19,5	-19,2
42,0	4,0	24,7	-20,8
43,0	4,0	25,2	-20,7
44,0	3,0	19,5	-21,0
45,0	3,0	18,5	-20,5
46,0	4,0	24,1	-20,6
47,0	4,0	24,1	-20,3
48,0	3,0	17,5	-19,9
49,0	3,0	17,5	-18,4
50,0	4,0	24,1	-19,1
51,0	4,0	23,1	-20,3
52,0	3,0	16,4	-20,4
53,0	3,0	16,5	-20,3
54,0	4,0	21,5	-21,0
55,0	3,0	16,0	-20,4
56,0	3,0	15,4	-19,9
57,0	3,0	14,3	-20,1
58,0	4,0	20,0	-19,2
59,0	4,0	19,5	-19,9
60,0	3,0	13,9	-19,1
61,0	4,0	19,5	-20,5

62.0	3.0	13.3	-20.9
63.0	4.0	13.5	-20.1
64.0	3.0	11.8	-19.7
65.0	3.0	11.8	-20.2
66.0	4.0	16.4	-19.6
67.0	3.0	9.2	-18.4
68.0	3.0	17.9	-19.3
69.0	4.0	20.5	-21.4
70.0	3.0	9.7	-19.4
71.0	2.0	8.8	-17.8
72.0	4.0	18.0	-21.9
73.0	4.0	13.8	-19.1
74.0	2.0	7.2	-17.1
75.0	3.0	14.9	-21.5
76.0	3.0	15.9	-20.9
77.0	1.0	0.	-16.5
78.0	2.0	6.2	-19.9
79.0	2.0	5.6	-21.7
80.0	1.0	0.	-15.7
81.0	3.0	10.8	-18.1
82.0	3.0	15.9	-23.7
83.0	1.0	0.	-15.6
84.0	1.0	0.	-17.3
85.0	2.0	4.1	-23.6
86.0	1.0	0.	-15.9
87.0	2.0	10.8	-17.7
88.0	3.0	9.2	-23.8
89.0	1.0	0.	-15.8
90.0	2.0	11.5	-19.1

SECTION IV

SIGNATURE SUPERPOSITION PROGRAM
A36 DOCUMENTATION

TABLE OF CONTENTS

SIGNATURE SUPERPOSITION PROGRAM

A36 Documentation

1. General. This exhibit is a documentation of Electronic Data Processing (EDP) Program A36, Signature Superposition Program, produced under Contract AF30(602)-67-0074 for RADC by the Fort Worth Division of General Dynamics. EDP program A36 was originally written for use with an IBM 7040-7090 direct coupled system; however, in this documentation the necessary changes have been incorporated to make the program compatible with the GE 625/635 computer at RADC. This documentation has been prepared in accordance with Electronic Data Processing (EDP) Programs and Program Documentation, Requirements for Preparation of, Exhibit RADC-3010 of 17 January 1964.

2. Abstract. The purpose of this procedure is to perform the analytic superposition of various generic radar targets using measured scattering data. The superposition of these generic shapes produces synthesized cross section and phase data for a composite radar target. The library data processed by this procedure is obtained from nagnetic tapes produced by procedure A24. The output of A36 can be obtained on magnetic tape and on a printed listing.

3. Machine Definition. The enclosed documentation is written in Fortran IV language using an IBM character set. This documentation is specifically designed for use with the GE 625/635 computer at RADC.

4. Program Description. Figure 1 contains a simplified logic diagram of A36. Basically, the program consists of a main program and a set of subroutines. These divisions are described below.

4.1 Main Program. The main program is used to call problems and subroutines and to assign the correct unit designations to each of the three library tapes which may be used as input.

4.2 Subroutine READT. This subroutine is used to read cross section, phase, and azimuth data from the library tapes.

4.3 Subroutine FLFXR. This subroutine is used to convert the fixed point library data to floating point for use in the main computations, and to convert composite cross section, phase, and azimuth data back to fixed point for output.

4.4 Subroutine EXEC. This subroutine processes and accumulates cross section and phase data for each shape and computes the composite data for the composite shape.

4.5 Subroutine PL4020. This subroutine plots the composite data as a function of aspect angle.

4.6 Subroutine OUTPR(6). This subroutine writes composite data on Unit 6 for listing.

4.7 Subroutine OUTPR(8). This subroutine writes composite data on the magnetic tape on Unit 8.

4.8 Subroutine ZEROS. This subroutine places zeros (0.) in a large number of storage locations.

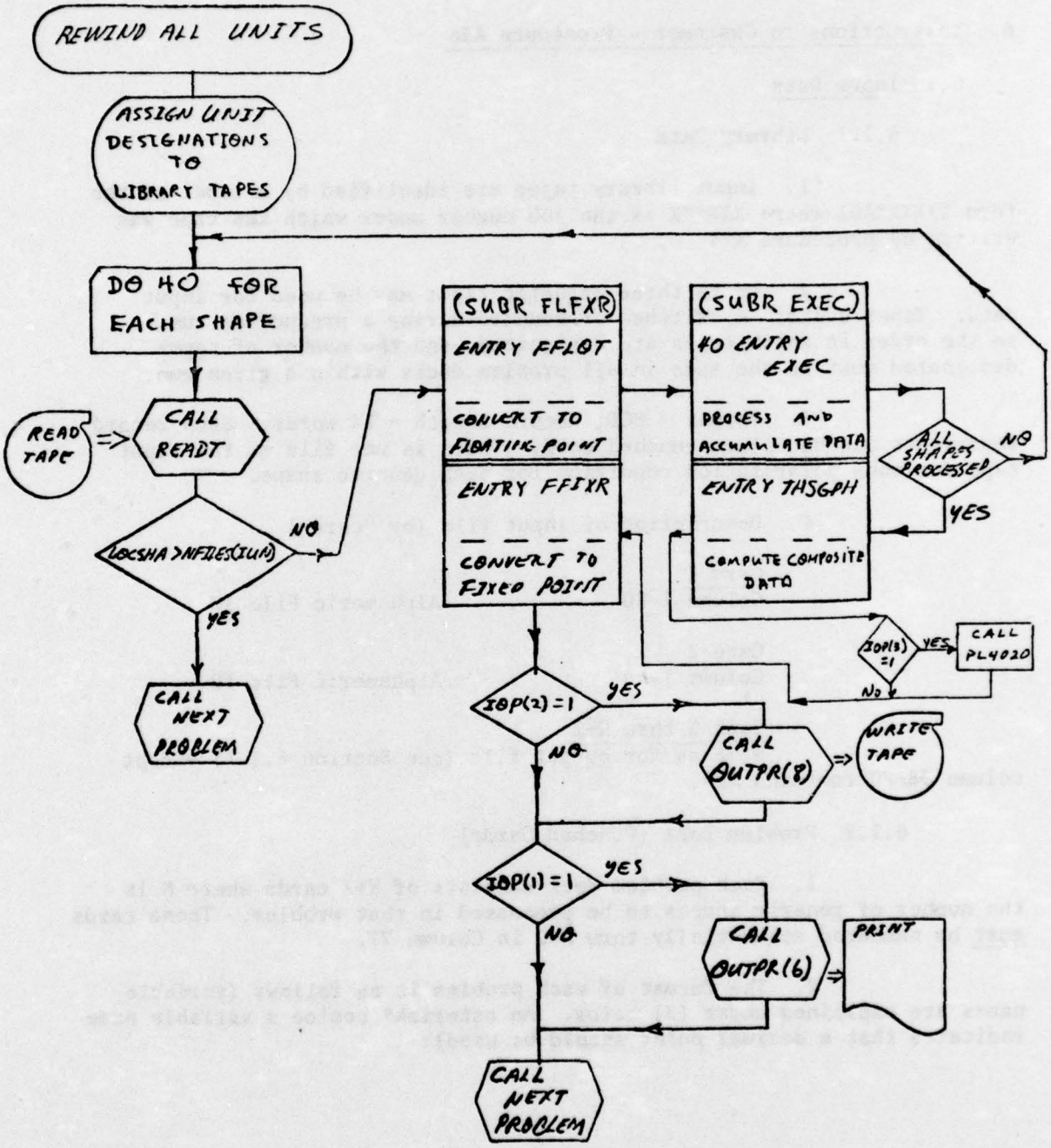

FIGURE 1. A36 LOGIC DIAGRAM

6. Instructions to Customer - Procedure A36

6.1 Input Data

6.1.1 Library Data

1. Input library tapes are identified by a label of the form XXXXXXA01 where XXXXXX is the job number under which the tape was written by procedure A24.

2. Up to three magnetic tapes may be used for input data. Tapes cannot be switched or mounted during a production run, so the order in which tapes are designated, and the number of tapes designated must be the same in all problem decks within a given run.

3. Format - BCD; Record Length = 14 words. Each record represents one 80 column punched card. There is one file on the input tape for each polarization condition for each generic shape.

4. Description of input file (by "card")

Card 1	
Column 1-80	Alphameric File ID

Card 2	
Column 1-80	Alphameric File ID

Card 3 thru N+2

Same as for output file (see Section 6.2.1) except column 78-80 contains A24.

6.1.2 Problem Data (Punched Cards)

1. Each problem deck consists of N+2 cards where N is the number of generic shapes to be processed in that problem. These cards must be numbered sequentially thru N+2 in Column 77.

2. The format of each problem is as follows (variable names are explained under (3) below. An asterisk* beside a variable name indicates that a decimal point should be used):

Card 1

Col 1-30	COMTRG
Col 31-33	NSHAPS
Col 34-37	NPTS
Col 38-40	IPITCH
Col 41-43	IROLL
Col 44	IPOL(1)
Col 45	IPOL(2)
Col 46-51	FREQ *
Col 52-55	IDLTH
Col 56-60	ITHTAO
Col 61-62	NTAPES

Card 2

Col 1-6	IFILID(1)
Col 7-9	NFILES(1)
Col 10	BLANK
Col 11-16	IFILID(2)
Col 17-19	NFILES(2)
Col 20	BLANK
Col 21-26	IFILID(3)
Col 27-29	NFILES(3)
Col 30-32	BLANK
Col 33	IOP(1)

Col 34	IOP(2)
Col 35	IOP(3)
Col 36	IOPI(1)
Col 37	IOPI(2)
Col 38-43	ISGMIN
Col 44-49	ISGMAX
Col 50-62	BLANK

Cards 3 through NSHAPS + 2 (One card per generic shape)

Col 1	IUN
Col 2-4	LOCSHA
Col 5-8	± AZSFT
Col 9	NSHADS
Col 10-13	ISHADW (1,1)
Col 14-17	ISHADW (2,1)
Col 18-21	ISHADW (1,2)
Col 22-25	ISHADW (2,2)
Col 26-29	ISHADW (1,3)
Col 30-33	ISHADW (2,3)
Col 34-37	ISHADW (1,4)
Col 38-41	ISHADW (2,4)
Col 42-47	RHO
Col 48-53	DEE
Col 56-60	BLANK

All Cards

Col 63-68	Job Number (supplied by Operation group)
Col 69	P
Col 70-72	Problem deck number
Col 78-80	A36

All data beside which no * appears must be right adjusted in the specified columns (except COMTRG, which is any combination of 30 alphabetic and numeric-characters) without decimal point.

3. Input Variables

UNITS	NAME	USE
--	COMTRG	30 Character composite target id
--	NSHAPS	Number of generic shapes for problem
--	NPTS	Number of points to be processed
Deg	IPITCH	Pitch Angle
Deg	IROLL	Roll Angle
--	IPOL(1)	Transmitter polarization (H or V)
--	IPOL(2)	Receiver polarization (H or V)
GHz	FREQ	Frequency
Deg	IDLTH	Azimuth increment for processing (X10)
Deg	ITHTAD	Initial azimuth for processing (X10)
--	NTAPES	No. of input tapes used
--	IFILID(N)	Col. 63-68 of Nth input tape (File Tape ID)

UNITS	NAME	USE
--	NFILES(N)	No. of files on Nth input tape
--	IOP(2)	1, write tape; 0, do not write tape
--	IOP(1)	1, print; 0, do not print
--	IOP(3)	1,plots desired; 0, no plots desired
--	IOPI(1)	1, plot amplitude; 0, do not plot amplitude
--	IOPI(2)	1, plot phase; 0, do not plot phase
Db	ISIGMIN	MINIMUM ampl. for plots (x10)
Db	ISIGMAX	MAXIMUM ampl. for plots (x10)
--	IUN	Input tape for shape (1,2,or 3)
--	LOCSHA	File (of input tape) which contains shape
--	IAZSFT	Processing will start at IAZSFTth azimuth
--	NSHADS	Number of shadow regions for shape (0,1,2,3,o4 4)
--	ISHDW(1,J)	Subscript of start azimuth of Jth SHADOW
--	ISHADW(2,J)	Subscript of end azimuth of Jth SHADOW
	RHO	Aspect Angle used for positioning generic shape
inches	DEE	Radius arm length associated with RHO in positioning generic shape
Degrees	IPHIZ	

6.2 Output Data

6.2.1 Magnetic Tape

1. Format - BCD; Record length - 14 words. Each record represents one 80 column punched card. There is one file on the output tape for each composite shape.

2. Description of output file (by "card").

Card 1	
Column 1-80	Alphameric File ID
Card 2	
Column 1-80	Alphameric File ID
Cards 3 thru N+2	(where N= NPTS/4 +J; J=) if NPTS=0 mod 4, J=1 otherwise)
Column 1	Blank
Column 2-6	1st azimuth value (degrees X10)
Column 7-10	1st ampl. values (dBsm X10)
Column 11-14	1st phase values (degrees)
Column 15-28	Repeat 1-14 for 2nd values
Column 29-42	Repeat 1-14 for 3rd values
Column 43-56	Repeat 1-14 for 4th values
Column 57-62	Blank
Column 63-68	Six digit tape number
Column 69	"P"
Column 70-72	Three digit file number
Column 73-77	Five digit card number
Column 78-80	A36

6.2.2 Printed Output

The printed output of Procedure A36 consists of a listing which is identical in format to the output tape described in 6.2.1. Each printed line represents one tape record "card".

```
      COMMON/P/ NSHAPS, LOCSHA, IFILE(12), IAZSFT, NPT, IUN, NFILES(12),
     1         NPTS, IDLTH, NSHADS, ISHADW(2,4), PHO, DEE, IOP1(2),
     2         IOP(3), COMTRG(5), IBSFLE,    IPITCH, IROLL, IPOL(2),
     3         FREQ, SQSGRE, SQSGIM, PH, ICOUNT, IDATA(3610,4),
     4         IFDES(3), IPHIZ  ,IEOF(12)


      DIMENSION  CRESIG(3610), CIMSIG(3610), SIG(3610), PHI(3610),
     1   THET(3610), AMSIG(3610), AMPHI(3610)  ,
     2 CARD(10),XPAR(8),YPAR(8), X1(2), Y1(2)


      EQUIVALENCE  ( CRESIG(1), IDATA(1,3)),
     1             ( CIMSIG(1), IDATA(1,4)),
     2             (   THET(1), IDATA(1,1)),
     3             (    SIG(1), IDATA(1,2)),
     4             (    PHI(1), IDATA(1,3)),
     5             (  AMSIG(1), IDATA(1,1)),
     6             (  AMPHI(1), IDATA(1,2))



      COMMON /BLOCK1/ THETA0,IDLTI
      COMMON /BLOCK2/ SIGMIN,SIGMAX
      COMMON /BLOCK3/  IFILID(3), NRUN

    5 NRUN = 0
      PRINT 2222
 2222 FORMAT (53H AT COMPLETION, SAVE TAPE ON UNIT 08 AS PER JOB SHEET)

      REWIND 08

   10  REWIND 12
      IFILE(12) = 1
      REWIND 10
      IFILE(10)= 1
      REWIND 11
      IFILE(11)= 1
   20 CALL ZEROS
      NRUN = NRUN + 1
      READ (5,1005) COMTRG,NSHAPS,NPTS,IPITCH,IROLL,IPOL,FREQ,
     1              IDLTH,ITHTA0,NTAPES, (IFILID(J),NFILES(J),J=1,3),
     2                IDLTI, IOP, IOP1, ISGMIN, ISGMAX, IBSFLE
C           COMTRG --- 30 CHARACTER COMPOSITE TARGET ID
C           NSHAPS --- NUMBER OF GENERIC SHAPES TO BE PROCESSED
C             NPTS --- NUMBER OF POINTS TO BE READ FROM TAPE(S)
C           IPITCH --- PITCH ANGLE
C            IROLL --- ROLL  ANGLE
C          IPOL(1) --- TRANSMITTER POLARIZATION  (H OR V)
C          IPOL(2) ---    RECEIVER POLARIZATION  (H OR V)
C             FREQ --- FREQUENCY (GHZ)
```

```
C          IDLTH --- AZIMUTH INCREMENT FOR PROCESSING
C          ITHTA0 --- INITIAL  AZIMUTH  FOR PROCESSING
C          NTAPES --- NUMBER OF INPUT TAPES  (1,2, OR 3)
C       IFILID(J) --- COL. 63-68 OF  JTH INPUT TAPE
C       NFILES(J) --- NUMBER OF FILES ON JTH INPUT TAPE
C          IOP(1) --- 1,PRINT          0,NO PRINT
C          IOP(2) --- 1,TAPE           0,NO TAPE
C          IOP(3) --- 1,PLOTS          0,NO PLOTS
C         IOP1(1) --- 1,PLOT SIGMA     0,DO NOT PLOT SIGMA
C         IOP1(2) --- 1,PLOT PHASE     0,DO NOT PLOT PHASE
C          ISGMIN --- MINIMUM SIGMA VALUE FOR PLOT
C          ISGMAX --- MAXIMUM SIGMA VALUE FOR PLOT
C          IBSPLE --- PLOTTING INCREMENT
C
C
      IF (NRUN .NE. 1 )  GO TO 15
C**** CHECK UNIT SETUPS **
      LIM = 9 + NTAPES
      DO    13   IUNIT = 10,LIM
       READ (IUNIT,1001) (CARD(I),I=1,10)
       READ (IUNIT,1000) (CARD(I),I=1,8)
      READ (IUNIT,1000) IFILEI
      DO    11   I = 1,NTAPES
   11 IF ( IFILID(I) .EQ. IFILEI )  GO TO 12
      GO TO 14
   12 IFDES(I) = IUNIT
      WRITE (6,3006) IFDES(I)
 3 06 FORMAT ( I7)
      NFILES(IUNIT) = NFILES(I)
   13 REWIND IUNIT
      GO TO 15
   14 WRITE (6,2000)  IFILEI, IUNIT
      CALL EXIT
C**** UNITS ASSIGNED--EXECUTE PROBLEM **
   15 IF(IDLTH .LE. 0) IDLTH = 1
      IDLTI = IDLTH
      THETA  = FLOAT(ITHTA0) / 10.0
      SIGMIN = FLOAT(ISGMIN) / 10.0
      SIGMAX = FLOAT(ISGMAX) / 10.0
      DO    40   NSHAPE = 1, NSHAPS
      READ (5,2005) IUN,LOCSHA,IAZSFT,NSHADS,((ISHADW(I,J),I=1,2),J=1,4)
     1,              RHO,DEE,IPHIZ
      IF (IAZSFT .LE. 0) IAZSFT = 1
      IUN = IFDES(IUN)
C**** SUBROUTINE READT READS DATA FOR GENERIC SHAPE **
      CALL READT(KERROR)
      GO TO (1,2)     , KERROR
C**** ENTRY FFLOT(SUBR FLFXR) CONVERTS DATA TO FLOATING PT.**
    1 CALL FFLOT
C**** SUBROUTINE EXEC PROCESSES AND ACCUMULATES DATA FOR EACH SHAPE **
   40 CALL EXEC
C**** ENTRY THSGPH(SUBR EXEC) CALCULATES COMPOSITE OF GENERIC SHAPES **
```

```
      CALL THSGPH
C**** SUBROUTINE PL4020 PLOTS COMPOSITE DATA ON RADC PLOTTER
      IF(IOP(3).EQ. 1) CALL PL4020
C**** ENTRY FFIXR(SUBR FLFXR) CONVERTS COMPOSITE DATA TO INTEGER **
      CALL FFIXR
C**** SUBROUTINE OUTPR(J) WRITES COMPOSITE DATA ON UNIT J **
      IF (IOP(2) .EQ. 1) CALL OUTPR(8)
      IF (IOP(1) .EQ. 1)  CALL OUTPR(6)
C***** PROBLEM COMPLETE AT THIS POINT **
      GO TO 20
C    2--FILE REQUESTED GREATER THAN NO.OF FILES ON TAPE.
     2 WRITE (6,1006)  LOCSHA, NFILES(IUN), IUN
      GO TO 10

C*****FORMAT STATEMENTS*****
 1 00 FORMAT (62X, I6)
 1 01 FORMAT(10A6)
 1 05 FORMAT(5A6,I3,I4,2I3,2A1,F6.3,I4,I5,I2/3(I6,I3,1X),I2,5I1,3I6)
 2 05 FORMAT ( I1,I3,I4, I1,8I4,F6.3,F6.3,2X,I5)
 1 06 FORMAT ( I3, 6H REQ.,, I3, 14H FILES ON TAPE, I2)
 2 00 FORMAT (6H FILE ,I6,10H  ON UNIT ,I2,12H  NOT REQ D.)
C**************************
 1003 FORMAT(10X,27HINPUT ERROR ON FIRST RECORD)
 1 04 FORMAT(10X,28HINPUT ERROR ON SECOND RECORD)
 1 07 FORMAT(10X,33HINPUT ERROR ON SUCCEEDING RECORDS)
      END
```

```
      SUBROUTINE READT(KERROR)

      COMMON/P/ NSHAPS, LOCSHA, IFILE(12), IAZSFT, NPT, IUN, NFILES(12),
     1         NPTS, IDLTH, NSHADS, ISHADW(2,4), RHO, DEE, IOP1(2),
     2         IOP(3), COMTRG(5), IBSPLE,    IPITCH, IROLL, IPOL(2),
     3         FREQ, SQSGRE, SQSGIM, PH, ICOUNT, IDATA(3610,4),
     4         IPDES(3), IPHIZ, IEOF(12)
      COMMON /FLAG / ITEM

       DIMENSION CARD (10)
      DIMENSION  CRESIG(3610), CIMSIG(3610), SIG(3610), PHI(3610),
     1   THET(3610), AMSIG(3610), AMPHI(3610)


      EQUIVALENCE  ( CRESIG(1), IDATA(1,3)),
     1             ( CIMSIG(1), IDATA(1,4)),
     2             (   THET(1), IDATA(1,1)),
     3             (    SIG(1), IDATA(1,2)),
     4             (    PHI(1), IDATA(1,3)),
     5             (  AMSIG(1), IDATA(1,1)),
     6             (  AMPHI(1), IDATA(1,2))



      KERROR = 1

      IF (LOCSHA .GT. NFILES(IUN))  GO TO 50

   10 CALL FLGEOF(IUN,IEOF(IUN))
      IF (LOCSHA .NE. IFILE (IUN))  GO TO 30
       READ (IUN,1008) (CARD(I),I=1,10)
       READ (IUN,1008) (CARD(I),I=1,6)
      READ(IUN,2008)  (( IDATA(NPT,NVAR),NVAR=1,2),NPT=1,NPTS)

   20 READ(IUN,1009) BLANK
      IF (IEOF(IUN)  .GT. 0)  GO TO 60
      GO TO 20

   30 IF (LOCSHA .GT. IFILE (IUN))   GO TO 40
      REWIND IUN
      IFILE(IUN) = 1
      GO TO 10
   40 DO 41 NCARD =1,900
      READ(IUN,1009) BLANK
   41 CONTINUE
   42 READ(IUN,1009) BLANK
      IF(IEOF(IUN) .LE. 0) GO TO 42
      IEOF(IUN) = 0

      IFILE(IUN) = IFILE(IUN) + 1
      GO TO 10
```

```
   50 KERROR = 2
      RETURN

   60 IFILE(IUN) = IFILE(IUN) + 1
      IEOF(IUN) = 0
      RETURN

C**** FORMAT STATEMENTS ****
 1 08 FORMAT(10A6)
 1 09 FORMAT(A6)
 2 08 FORMAT ( 4( 6X,2I4))
C*****************************

      END
```

```
      SUBROUTINE FLFXR
FIRST DELIMITER OF SUBROUTINE STATEMENT IS ILLEGAL

     1        NPTS, IDLTH, NSHADS, ISHADW(2,4), RHO, DEE, IOP1(2),
     2        IOP(3), COMTRG(5), IBSFLE,    IPITCH, IROLL, IPOL(2),
     3        FREQ, SQSGRE, SQSGIM, PH, ICOUNT, IDATA(3610,4),
     4        IFDES(3), IPHIZ, IEOF(12)

      DIMENSION  CRESIG(3610), CIMSIG(3610), SIG(3610), PHI(3610),
     1   THET(3610), AMSIG(3610), AMPHI(3610)


      EQUIVALENCE  ( CRESIG(1), IDATA(1,3)),
     1             ( CIMSIG(1), IDATA(1,4)),
     2             (   THET(1), IDATA(1,1)),
     3             (    SIG(1), IDATA(1,2)),
     4             (    PHI(1), IDATA(1,3)),
     5             (  AMSIG(1), IDATA(1,1)),
     6             (  AMPHI(1), IDATA(1,2))


      ENTRY FFLOT
FUNCTION ENTRY MUST HAVE AN ARGUMENT LIST
ENTRY STATEMENT IS ILLEGAL IN MAIN
      DO   10   NPT = 1,NPTS
      AMSIG(NPT) = FLOAT(IDATA(NPT,1)) / 10.0
IDATA IS AN UNDIMENSIONED ARRAY OR AN INVALID FUNCTION
   10 AMPHI(NPT) =       IDATA(NPT,2)
IDATA IS AN UNDIMENSIONED ARRAY OR AN INVALID FUNCTION
      RETURN
RETURN STATEMENT IS ILLEGAL IN MAIN
      ENTRY FFIXR
FUNCTION ENTRY MUST HAVE AN ARGUMENT LIST
ENTRY STATEMENT IS ILLEGAL IN MAIN
      DO   20   NPT = 1,ICOUNT
       RND = 0.5
      IF ( THET(NPT) .LT. 0.) RND = -0.5
      IDATA(NPT,1) = THET(NPT) * 10.0 + RND
IDATA IS AN UNDIMENSIONED ARRAY OR A MISPLACED ASF
       RND = 0.5
      IF ( SIG(NPT) .LT. 0.)  RND = -0.5
      IDATA(NPT,2) =   SIG(NPT)  *  10.0 + RND
IDATA IS AN UNDIMENSIONED ARRAY OR A MISPLACED ASF
   20 IDATA(NPT,3) =   PHI(NPT)          + 0.5
IDATA IS AN UNDIMENSIONED ARRAY OR A MISPLACED ASF
      RETURN
RETURN STATEMENT IS ILLEGAL IN MAIN
      END
'STOP' STATEMENT IS MISSING-SIMULATED
IDATA IS USED AS AN ARRAY IN AN EQUIVALENCE STATEMENT BUT IS NOT DIMENSIONED
IDATA IS USED AS AN ARRAY IN AN EQUIVALENCE STATEMENT BUT IS NOT DIMENSIONED
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IDATA IS USED AS AN ARRAY IN AN EQUIVALENCE STATEMENT BUT IS NOT DIMENSIONED
IDATA IS USED AS AN ARRAY IN AN EQUIVALENCE STATEMENT BUT IS NOT DIMENSIONED
IDATA IS USED AS AN ARRAY IN AN EQUIVALENCE STATEMENT BUT IS NOT DIMENSIONED
IDATA IS USED AS AN ARRAY IN AN EQUIVALENCE STATEMENT BUT IS NOT DIMENSIONED
IDATA IS USED AS AN ARRAY IN AN EQUIVALENCE STATEMENT BUT IS NOT DIMENSIONED
```

```
      SUBROUTINE EXEC

      COMMON/P/ NSHAPS, LOCSHA, IFILE(12), IAZSFT, NPT, IUN, NFILES(12),
     1         NPTS, IDLTH, NSHADS, ISHADW(2,4), RHO, DEE, IOP1(2),
     2         IOP(3), COMTRG(5), IBSFLE,    IPITCH, IROLL, IPOL(2),
     3         FREQ, SQSGRE, SQSGIM, PH, ICOUNT, IDATA(3610,4),
     4         IPDES(3), IPHIZ, IEOF(12)

      DIMENSION  CRESIG(3610), CIMSIG(3610), SIG(3610), PHI(3610),
     1   THET(3610), AMSIG(3610), AMPHI(3610)


      EQUIVALENCE  ( CRESIG(1), IDATA(1,3)),
     1             ( CIMSIG(1), IDATA(1,4)),
     2             (   THET(1), IDATA(1,1)),
     3             (    SIG(1), IDATA(1,2)),
     4             (    PHI(1), IDATA(1,3)),
     5             (  AMSIG(1), IDATA(1,1)),
     6             (  AMPHI(1), IDATA(1,2))


      COMMON /BLOCK1/ THETA0,NTH
      DATA  PI180 / .174532925E-1/
      DLTHT = FLOAT(IDLTH) / 10.0
      COEFF = DEE * 720. * FREQ  / 11.81
      N1 = NPTS
      I1 = IAZSFT
      ICOUNT = 0
    5 DO   20   NPT = I1,N1,NTH
      ICOUNT = ICOUNT + 1

      IF ( NSHADS .LE. 0)  GO TO 11
      DO   10   K=1,NSHADS
   10 IF (NPT  .GE. ISHADW(1,K)          .AND.
     1    NPT  .LE. ISHADW(2,K        ))  GO TO 20
   11 ARG = PI180 * (RHO - DLTHT*FLOAT(ICOUNT-1))
       PHIZ = IPHIZ
       PHIZ = PHIZ /10.0
       PH = AMOD (AMPHI(NPT)+PHIZ + COEFF*COS(ARG), 360. )
        SQSG = 10.0 ** (AMSIG(NPT) / 20.0)
          ARG = PI180 * PH
      SQSGIM = SIN(ARG) * SQSG
      SQSGRE = COS(ARG) * SQSG
      CIMSIG(ICOUNT) = CIMSIG(ICOUNT) + SQSGIM
      CRESIG(ICOUNT) = CRESIG(ICOUNT) + SQSGRE
   20 CONTINUE
      IF (I1 .EQ. 1)  RETURN
      I1 = 1
      N1 = IAZSFT
      GO TO 5
```

```
      ENTRY THSGPH

      DO   30   NPT = 1,ICOUNT

      THET(NPT) = DLTHT * FLOAT(NPT-1) + THETA0
             A1 = CIMSIG(NPT)
             A2 = CRESIG(NPT)
            ARG = A1/A2
      ARG1 = A1*A1 + A2*A2
      IF( ARG1 .LE.  .000001) GO TO 301
      SIG(NPT) = 10.0 * ALOG10(ARG1)
      GO TO 35
  301 SIG(NPT) = -80.
   35 IF(ARG) 40,50,60

   40 IF (A1 ) 50,50,70
   60 IF (A1 ) 70,50,50
   70 ADJ = 180.0
      GO TO 80
   50 ADJ = 0.0
   80 PHASE = ATAN(ARG) / PI180  +  ADJ
      IF (PHASE .LE.  0.)    PHASE = PHASE + 360.0
   30  PHI(NPT) = PHASE
      RETURN
      END
```

```
      SUBROUTINE OUTPR (K)

      COMMON/P/ NSHAPS, LOCSHA, IFILE(12), IAZSFT, NPT, IUN, NFILES(12),
     1         NPTS, IDLTH, NSHADS, ISHADW(2,4), RHO, DEF, IOP1(2),
     2         IOP(3), COMTRG(5), IBSFLE,    IPITCH, IROLL, IPOL(2),
     3         FREQ, SQSGRE, SQSGIM, PH, ICOUNT, IDATA(3610,4),
     4         IFDES(3), IPHIZ, IEOF(12)

      DIMENSION  CRESIG(3610), CIMSIG(3610), SIG(3610), PHI(3610),
     1   THET(3610), AMSIG(3610), AMPHI(3610)


      EQUIVALENCE  ( CRESIG(1), IDATA(1,3)),
     1             ( CIMSIG(1), IDATA(1,4)),
     2             (   THET(1), IDATA(1,1)),
     3             (    SIG(1), IDATA(1,2)),
     4             (    PHI(1), IDATA(1,3)),
     5             (  AMSIG(1), IDATA(1,1)),
     6             (  AMPHI(1), IDATA(1,2))


      COMMON /BLOCK3/  ID1,DUMMY(2),ID2

      DIMENSION   IDOU(3)




      IUN = K
      IDOU(1) = ID1 + 1000000
      IDOU(2) = ID2 + 1000000
      IDOU(3) =       1000001


      WRITE (IUN,3000) COMTRG, IROLL,IPITCH, IPOL, FREQ



      NPT = 0
    5 NPT = NPT + 4
      NSTART = NPT - 3
      INDX = ICOUNT - NSTART + 1
      IF (INDX .LT.  4   .AND.   INDX .GT.  0)  GO TO(2 ,30,4 ),INDX
      IF (INDX .EQ. 0)  GO TO 50
   10 WRITE(IUN,1000) ((IDATA(I,J),J=1,3),I=NSTART,NPT ), IDOU
      IDOU(3) = IDOU(3) + 1


      GO TO 5
```

```
   20 WRITE(IUN,2000) ((IDATA(I,J),J=1,3),I=NSTART,NPTS), IDOU
      GO TO 50

   30 WRITE(IUN,3000) ((IDATA(I,J),J=1,3),I=NSTART,NPTS), IDOU
      GO TO 50

   40 WRITE(IUN,4000) ((IDATA(I,J),J=1,3),I=NSTART,NPTS), IDOU
   50 IF (IUN .EQ. 8)  ENDFILE 8
      RETURN
C*****FORMAT STATEMENTS****
 1 00 FORMAT (   4(1X,I5,I4,I4), 6X, I6,1HP,I3,I5,3HA36)
 2 00 FORMAT (   1(1X,I5,I4,I4),48X, I6,1HP,I3,I5,3HA36)
 3 00 FORMAT (   2(1X,I5,I4,I4),34X, I6,1HP,I3,I5,3HA36)
 4 00 FORMAT (   3(1X,I5,I4,I4),20X, I6,1HP,I3,I5,3HA36)
 5 00 FORMAT (   1H ,5A6,2HRA,I3,2HPA,I3,4H P T,A1,2H R,A1,4H  F ,F6.3,
     13HGHZ,18H                    /
     2           19H FORMAT(AZ,SIG,PHA),
     3 61H                                                          )

      END
```

```
      SUBROUTINE ZEROS

      COMMON/P/  FILLER(7280), ZERO(7220)
      DO    10   I=1,7220
   10 ZERO(I) = 0.0
      RETURN
      END
```

```
      SUBROUTINE PL4020
      COMMON/P/ NSHAPS, LOCSHA, IFILE(12), IAZSFT, NPT, IUN, NFILES(12),
     1         NPTS, IDLTH, NSHADS, ISHADW(2,4), RHO, DEE, IOP1(2),
     2         IOP(3), COMTRG(5), IBSFLE,    IPITCH, IROLL, IPOL(2),
     3         FREQ, SQSGRE, SQSGIM, PH, ICOUNT, IDATA(3610,4),
     4         IFDES(3), IPHIZ  ,IEOF(12)
      COMMON /BLOCK2/ SIGMIN,SIGMAX

      DIMENSION  CRESIG(3610), CIMSIG(3610), SIG(3610), PHI(3610),
     1   THET(3610), AMSIG(3610), AMPHI(3610), A(3610), Y(3610,2),
     2   ISTART(2), IEND(2), IHEAD(8), AZMIN(2), AZMAX(2)  ,
     3 CARD(10), XPAR(8), YPAR(8), X1(2), Y1(2)

      EQUIVALENCE  ( CRESIG(1), IDATA(1,3)),
     1             ( CIMSIG(1), IDATA(1,4)),
     2             (   THET(1), IDATA(1,1)),
     3             (    SIG(1), IDATA(1,2)),
     4             (    PHI(1), IDATA(1,3)),
     5             (  AMSIG(1), IDATA(1,1)),
     6             (  AMPHI(1), IDATA(1,2)),
     7             (      A(1), IDATA(1,1)),
     8             (    Y(1,1), IDATA(1,2))

C**** XPAR  AND  YPAR  ARRAY PARAMETERS ARE DEFINED AS FOLLOWS
C***       XPAR(1) = X CORNER           YPAR(1) = Y CORNER
C***       XPAR(2) = X SIZE OF PAPER    YPAR(2) = Y SIZE OF PAPER
C***       XPAR(3) = X ORIGIN           YPAR(3) = Y ORIGIN
C***       XPAR(4) = X SCALE            YPAR(4) = Y SCALE
C***       XPAR(5) = PRINT MODE SELECT  YPAR(5) = PRINTER SYMBOL SELECT
C***       XPAR(6) = X ERROR COUNT      YPAR(6) = Y ERROR COUNT
C***       XPAR(7) = X START            YPAR(7) = Y START
C***       XPAR(8) = X INCREMENT        YPAR(8) = Y INCREMENT
C
C***  PLOT SUBROUTINES ARE DEFINED AS FOLLOWS
C
C*** CALL  GRID(XINC,YINC,XPAR,YPAR,IND) USES XPAR AND YPAR 1,2
C*** CALL  LINE(XAR,YAR,IOUNT,XPAR,YPAR) USES XPAR AND YPAR 1,2,3,4,6
C*** CALL POINT(XAR,YAR,IOUNT,XPAR,YPAR) USES XPAR AND YPAR 1,2,3,4,5,6
C*** CALL NUMBER(VALUE,NDEC,XPAR,YPAR)USES XPAR 1,2,6,7,8 AND YPAR 1,2,7
C*** CALL PRINT(TEXT,COUNT,XPAR,YPAR) USES XPAR 1,2,6,7,8 AND YPAR 1,2,7
C*** CALL RANGE(ARRAY,INITIAL,LAST,RMAX,RMIN)
C***  XPAR(CORNER,PAPER SIZE, ORIGIN, SCALE, PRINT MODE, ERROR, START, IN
C***  YPAR(CORNER,PAPER SIZE, ORIGIN, SCALE, SYMBOL    , ERROR, START, IN

C***       XPAR( 1 , 2 , 3 , 4 , 5 , 6 , 7 , 8 )
      DATA XPAR/0.0,25.0,15.0,20.0,17.0,0.0,5.8,  .1/
C
C***       YPAR( 1 , 2 , 3 , 4 , 5 , 6 , 7 , 8 )
      DATA YPAR/0.0,25.0,12.0, 5.0,12.0,0.0,1.5,  .0/


      IOUNT =3600/IFSFLE
```

```
  5 IF(IOP1(1) .NE. 1) GO TO 105
    IF(IBSFLE .LE. 0) IBSFLE = 1
999 FORMAT(1X,16F4.1)
    WRITE(6,999)((XPAR(KK),KK=1,8),(YPAR(LL),LL=1,8))
 10 CALL GRID(1.0,1.0,XPAR,YPAR,1)
    WRITE(6,999)((XPAR(KK),KK=1,8),(YPAR(LL),LL=1,8))
    CALL NUMBER(-180.0,1,XPAR,YPAR)
    XPAR(7) =14.8
 15 CALL NUMBER( 0.0,1,XPAR,YPAR)
    XPAR(7) = 23.8
    CALL NUMBER(180.0,1,XPAR,YPAR)
    XPAR(7) = 5.0
    YPAR(7) = 2.0
    YB = SIGMIN
    YT = SIGMAX
 20 CALL NUMBER(YB,1,XPAR,YPAR)
    YPAR(7) = 12.0
    CALL NUMBER(YT,1,XPAR,YPAR)
    YPAR(3) =12.0 - YT
    WRITE(6,999)((XPAR(KK),KK=1,8),(YPAR(LL),LL=1,8))
888 FORMAT (1X,2F12.6)
    WRITE(6,888) A(1),Y(1,1)
 25 DO 60 NPT = 1,3600 ,IBSFLE
    NPT1 = NPT + IBSFLE
    X1(1)= A(NPT)
    X1(2)= A(NPT1)
    Y1(1)= Y(NPT,1)
    Y1(2)= Y(NPT1,1)
 60 CALL LINE(X1,Y1,IOUNT,XPAR,YPAR)
105 IF(IOP1(2).NE. 1)RETURN
    DATA YPAR/0.0,25.0,14.0,20.0,12.0,0.0,13.5,0.0/
110 CALL GRID(1.0,1.0,XPAR,YPAR,1)
    CALL NUMBER(-180.0,1,XPAR,YPAR)
    XPAR(7) = 14.8
115 CALL NUMBER(0.0,1,XPAR,YPAR)
    XPAR(7) = 23.8
    CALL NUMBER(180.0,1,XPAR,YPAR)
    XPAR(7)= 5.0
    YPAR(7)= 14.0
120 CALL NUMBER(0.0,1,XPAR,YPAR)
    YPAR(7)= 19.0
    CALL NUMBER(180.0,1,XPAR,YPAR)
    YPAR(7)= 24.0
    CALL NUMBER(360.0,1,XPAR,YPAR)
    WRITE(6,999)((XPAR(KK),KK=1,8),(YPAR(LL),LL=1,8))
125 DO 16   NPT = 1,3600,IBSFLE
    NPT1 =NPT +IBSFLE
    X1(1) = A(NPT)
    X1(2) = A(NPT1)
    Y1(1) = Y(NPT,2)
    Y1(2) = Y(NPT1,2)
160 CALL LINE(X1,Y1,IOUNT,XPAR,YPAR)
```

```
  105            CALL STDBY
  106            CALL STDBY
  107            RETURN
  108            END
NON-BLANK CHARACTERS IN COLUMNS 1-5 ILLEGAL- CHECK FORM/NFORM OPTION
FIRST WORD OF STATEMENT IS UNRECOGNIZABLE OR THE FIRST DELIMETER IS ILLEGAL
NON-BLANK CHARACTERS IN COLUMNS 1-5 ILLEGAL- CHECK FORM/NFORM OPTION
  109       CHECKOUT TARGET F2Y5F3-F5CY5    2[illegible]0  0  0HH5,9[illegible]5     1-180[illegible] 1          1
  110       [illegible]65951 [illegible]8                    10100  -4[illegible]0   10[illegible]     1-180[illegible] 1          1
  111       1  1   0119003600                                0.     [illegible].                        1
STATEMENT LABEL MUST BE BETWEEN 1 AND 99999
. IS ILLEGAL AS THE FIRST CHARACTER OF A STATEMENT
STATEMENT IS NEVER REFERENCED
  112       1  2   1[illegible]11700                          0.     .                                   1
STATEMENT LABEL MUST BE BETWEEN 1 AND 99999
. IS ILLEGAL AS THE FIRST CHARACTER OF A STATEMENT
RETURN STATEMENT MISSING-SIMULATED
'END' STATEMENT MISSING-SIMULATED
```

8.0 Sample Problem

8.1 Description

The enclosed sample problem identified by job number 064052-001 superimposes measured signature data for generic Models F5 and Cy5. Model F5 data is contained on file number 2 of A24 library tape 964216A01 and Model Cy5 data is contained on file number 3 of the same tape. There are 3600 data points per shape and pitch and roll angles are both zero degrees. The library data was obtained using horizontally polarized transmitter and receiver antennas at a frequency of 5.885 gHz. The values of the radius arm angle (RHO) and the radius arm length (DEE) necessary to obtain the composite shape are given in the input data. The value of IPHIZ required to correct the phase of each generic shape is also given in the input data. The values of RHO, DEE, and IPHIZ are obtained from the location geometry and measured phase data for each generic shape.

DEE and RHO are the polar coordinates required to synthesize the location of each shape in its respective position as a component of the composite shape. For example, if Frustrum F5 were aligned as shown in Figure 1a when originally measured, values of DEE = 8.2 inches and RHO = 7.6 degrees would be required to shift the reference point (in this case, the center of the large face of the frustrum) so that the composite Model F5CY5 could be formed as shown in Figure 1b.

Subroutine EXEC utilizes the values of RHO, DEE, IPHIZ, and measured phase to compute the value of phase which would be measured if the shape were actually located in the new position. The angle RHO is necessary to account for errors in alignment of the generic shape with respect to the center of rotation of the turntable.

8.2 Input Data

The attached Digital Computer Data Sheet gives the input data for this sample problem. Columns 33-55 of card #2 are used to provide instructions for the SC4020 plotter at GD/FW and may be ignored.

8.3 Output Data

The attached output listing gives the output data obtained using the data in Section 8.2 and the measured data obtained from files number 2 and 3 of the the library tape.

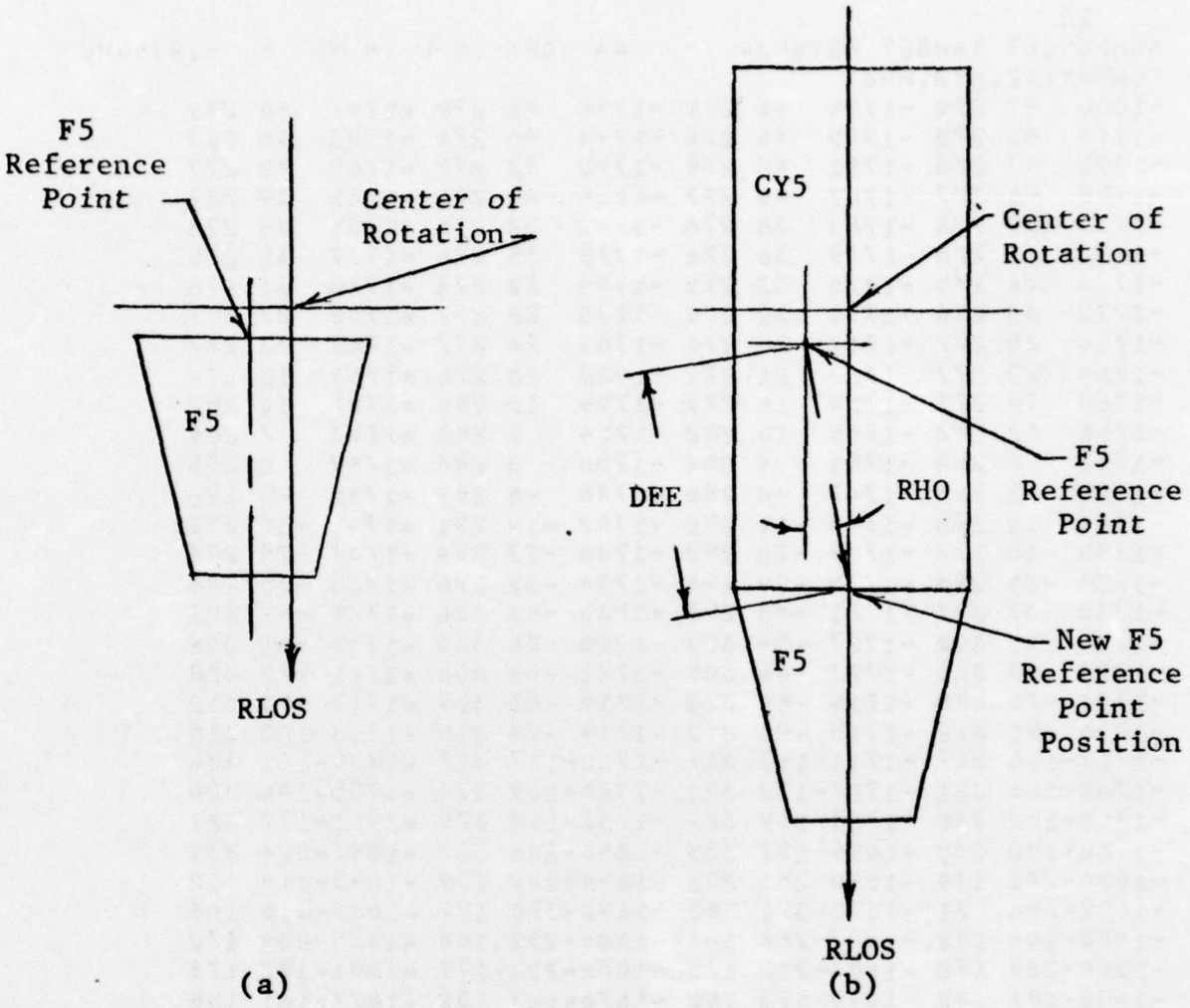

Fig. 1. RELATIONSHIP OF RHO AND DEE TO VEHICLE REFERENCE POINT LOCATION

```
    10
6CHECKOUT TARGET F2Y5F3-       RA  OPA  O P TH RH  P  5.975GHZ
FORMAT(AZ,SIG,PHA)
-1800  47 279 -1799  46 279 -1798  46 279 -1797  46 279
-1796  46 278 -1795  46 278 -1794  46 278 -1793  46 278
-1792  43 278 -1791  42 278 -1790  42 277 -1789  42 277
-1788  41 277 -1787  40 277 -1786  40 277 -1785  39 277
-1784  39 276 -1783  38 276 -1782  38 276 -1781  38 276
-1780  37 276 -1779  36 276 -1778  35 276 -1777  35 275
-1776  34 275 -1775  33 275 -1774  32 276 -1773  31 276
-1772  30 276 -1771  30 276 -1770  28 277 -1769  27 277
-1768  26 277 -1767  26 277 -1766  24 277 -1765  23 277
-1764  22 277 -1763  21 277 -1762  20 276 -1761  18 279
-1760  18 279 -1759  16 279 -1758  15 280 -1757  13 282
-1756  12 282 -1755  10 282 -1754   9 283 -1753   7 284
-1752   6 284 -1751   4 284 -1750   3 284 -1749   0 285
-1748  -2 286 -1747  -4 286 -1746  -6 287 -1745  -8 290
-1744 -11 290 -1743 -12 290 -1742 -14 291 -1741 -16 292
-1740 -18 293 -1739 -20 293 -1738 -23 294 -1737 -24 294
-1736 -26 295 -1735 -29 296 -1734 -32 296 -1733 -35 296
-1732 -37 297 -1731 -40 298 -1730 -43 300 -1729 -47 301
-1728 -50 302 -1727 -54 303 -1726 -56 303 -1725 -60 304
-1724 -63 306 -1723 -66 306 -1722 -69 306 -1721 -72 308
-1720 -76 308 -1719 -80 308 -1718 -83 309 -1717 -86 312
-1716 -91 312 -1715 -95 312 -1714 -98 315 -1713-103 315
-1712-106 317 -1711-112 317 -1710-117 317 -1709-121 320
-1708-126 321 -1707-132 321 -1706-139 324 -1705-146 326
-1704-152 326 -1703-159 327 -1702-168 329 -1701-177 329
-1700-186 330 -1699-197 335 -1698-208 337 -1697-224 339
-1696-241 344 -1695-261 351 -1694-282 359 -1693-314  12
-1692-344  51 -1691-371  83 -1690-350 127 -1689-316 146
-1688-286 162 -1687-266 168 -1686-252 168 -1685-234 170
-1684-223 172 -1683-212 175 -1682-201 177 -1681-192 178
-1680-181 180 -1679-173 182 -1678-167 182 -1677-161 185
-1676-157 186 -1675-153 187 -1674-149 187 -1673-146 188
-1672-144 190 -1671-140 190 -1670-139 189 -1669-136 191
-1668-134 193 -1667-132 193 -1666-131 194 -1665-129 196
-1664-128 198 -1663-127 199 -1662-126 201 -1661-125 202
-1660-125 202 -1659-124 203 -1658-124 204 -1657-124 212
-1656-124 212 -1655-126 212 -1654-127 212 -1653-127 215
-1652-128 217 -1651-130 219 -1650-131 221 -1649-132 222
-1648-133 224 -1647-135 226 -1646-136 228 -1645-137 232
-1644-140 237 -1643-142 239 -1642-144 240 -1641-147 240
-1640-149 242 -1639-152 246 -1638-155 248 -1637-158 248
-1636-161 251 -1635-164 255 -1634-167 259 -1633-170 262
```

```
-1632-174 265 -1631-176 269 -1630-181 275 -1629-185 277
-1628-188 281 -1627-193 280 -1626-195 281 -1625-197 287
-1624-201 290 -1623-204 292 -1622-206 296 -1621-209 300
-1620-211 303 -1619-213 306 -1618-215 308 -1617-216 313
-1616-217 316 -1615-217 317 -1614-216 324 -1613-218 326
-1612-216 329 -1611-219 332 -1610-220 334 -1609-222 339
-1608-224 340 -1607-223 343 -1606-230 344 -1605-233 351
-1604-237 360 -1603-242 360 -1602-247   1 -1601-252   7
-1600-261   7 -1599-270  10 -1598-281  13 -1597-292  11
-1596-307  12 -1595-323  14 -1594-337  15 -1593-362  17
-1592-393  17 -1591-400  21 -1590-400  30 -1589-400  43
-1588-395  74 -1587-358 184 -1586-333 229 -1585-311 239
-1584-298 240 -1583-288 240 -1582-274 240 -1581-266 240
-1580-257 240 -1579-250 240 -1578-245 242 -1577-238 244
-1576-235 243 -1575-231 247 -1574-227 252 -1573-225 252
-1572-224 253 -1571-222 259 -1570-222 260 -1569-218 260
-1568-217 265 -1567-216 271 -1566-217 271 -1565-216 274
-1564-216 278 -1563-217 279 -1562-217 282 -1561-215 287
-1560-214 287 -1559-214 291 -1558-212 296 -1557-211 296
-1556-209 299 -1555-206 306 -1554-207 310 -1553-204 309
-1552-202 314 -1551-199 325 -1550-197 326 -1549-194 328
-1548-192 333 -1547-190 336 -1546-189 337 -1545-186 344
-1544-185 352 -1543-183 352 -1542-183 357 -1541-182   1
-1540-181   1 -1539-182   2 -1538-181   8 -1537-182  11
-1536-184  11 -1535-186  13 -1534-186  20 -1533-189  21
-1532-192  21 -1531-194  22 -1530-197  22 -1529-201  22
-1528-206  28 -1527-212  29 -1526-216  29 -1525-223  35
-1524-229  37 -1523-237  38 -1522-244  39 -1521-255  43
-1520-262  45 -1519-274  49 -1518-284  52 -1517-300  59
-1516-313  66 -1515-327  82 -1514-334 103 -1513-338 121
-1512-333 132 -1511-325 156 -1510-315 166 -1509-308 171
-1508-295 184 -1507-291 187 -1506-281 188 -1505-280 192
-1504-273 192 -1503-270 193 -1502-267 197 -1501-272 197
-1500-274 197 -1499-276 198 -1498-278 198 -1497-284 200
-1496-290 199 -1495-299 200 -1494-308 200 -1493-322 200
-1492-332 200 -1491-352 197 -1490-367 191 -1489-377 185
-1488-376 173 -1487-361 147 -1486-340 130 -1485-313 110
-1484-300 101 -1483-285  94 -1482-271  92 -1481-259  85
-1480-250  83 -1479-241  83 -1478-236  78 -1477-230  74
-1476-225  73 -1475-220  77 -1474-218  77 -1473-216  75
-1472-213  75 -1471-212  77 -1470-212  77 -1469-212  77
-1468-211  81 -1467-217  81 -1466-217  85 -1465-220  88
-1464-222  88 -1463-224  90 -1462-229  93 -1461-232  97
-1460-233 100 -1459-237 108 -1458-240 118 -1457-243 125
-1456-243 135 -1455-242 147 -1454-239 148 -1453-233 159
-1452-229 167 -1451-224 168 -1450-219 174 -1449-214 177
-1448-212 179 -1447-208 188 -1446-199 190 -1445-194 191
-1444-190 193 -1443-187 197 -1442-183 201 -1441-180 204
-1440-179 205 -1439-178 207 -1438-177 209 -1437-176 211
-1436-178 216 -1435-180 216 -1434-181 217 -1433-184 220
-1432-185 220 -1431-188 220 -1430-191 221 -1429-195 226
-1428-200 227 -1427-207 227 -1426-212 227 -1425-220 230
-1424-231 232 -1423-239 233 -1422-249 235 -1421-264 242
-1420-276 246 -1419-290 252 -1418-308 257 -1417-325 272
-1416-341 286 -1415-343 302 -1414-336 318 -1413-314 345
-1412-304 356 -1411-288   2 -1410-277  12 -1409-268  14
-1408-262  15 -1407-255  19 -1406-252  19 -1405-249  19
-1404-248  19 -1403-247  19 -1402-246  19 -1401-249  19
```

-1400-252 19 -1399-254 19 -1398-258 19 -1397-262 19
-1396-262 18 -1395-267 18 -1394-272 16 -1393-279 15
-1392-283 12 -1391-285 8 -1390-291 4 -1389-293 360
-1388-297 347 -1387-297 337 -1386-297 331 -1385-301 320
-1384-298 315 -1383-297 307 -1382-295 297 -1381-298 295
-1380-297 292 -1379-302 287 -1378-301 286 -1377-309 284
-1376-312 281 -1375-320 279 -1374-329 276 -1373-340 271
-1372-349 268 -1371-366 263 -1370-384 254 -1369-393 249
-1368-392 233 -1367-372 213 -1366-349 178 -1365-323 150
-1364-309 138 -1363-294 135 -1362-281 128 -1361-269 125
-1360-256 125 -1359-250 122 -1358-243 120 -1357-239 119
-1356-235 118 -1355-232 117 -1354-230 116 -1353-228 115
-1352-227 115 -1351-230 114 -1350-232 113 -1349-234 113
-1348-237 112 -1347-243 112 -1346-249 112 -1345-256 111
-1344-262 111 -1343-278 111 -1342-288 111 -1341-304 110
-1340-345 111 -1339-373 117 -1338 599 120 -1337-400 170
-1336-394 286 -1335-332 285 -1334-307 285 -1333-281 285
-1332-263 283 -1331-254 283 -1330-245 281 -1329-232 281
-1328-226 281 -1327-220 281 -1326-214 281 -1325-210 281
-1324-209 281 -1323-206 281 -1322-204 281 -1321-205 281
-1320-207 281 -1319-209 281 -1318-211 281 -1317-216 281
-1316-219 285 -1315-229 285 -1314-235 285 -1313-240 288
-1312-253 293 -1311-265 297 -1310-278 301 -1309-294 301
-1308-314 310 -1307-331 327 -1306-335 335 -1305-331 12
-1304-316 43 -1303-299 54 -1302-284 57 -1301-263 68
-1300-253 75 -1299-244 77 -1298-233 77 -1297-227 76
-1296-222 79 -1295-218 80 -1294-216 80 -1293-215 81
-1292-215 81 -1291-216 81 -1290-219 82 -1289-220 82
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1260-400 281 1261-400 282 1262-400 283 1263-400 284
1264-400 291 1265-400 295 1266-398 298 1267-394 296
1268-391 297 1269-396 287 1270-392 287 1271-389 286
1272-396 276 1273-398 272 1274-398 267 1275-400 259
1276-400 251 1277-400 246 1278-400 234 1279-400 229
1280-400 227 1281-397 215 1282-391 216 1283-385 211
1284-379 206 1285-373 201 1286-357 194 1287-352 194
1288-346 181 1289-340 176 1290-335 171 1291-329 166
1292-324 160 1293-321 160 1294-317 151 1295-313 143
1296-309 145 1297-309 141 1298-305 135 1299-302 133
1300-300 133 1301-298 131 1302-298 124 1303-296 124
1304-299 120 1305-298 114 1306-296 114 1307-294 112
1308-300 103 1309-300 99 1310-298 97 1311-297 94
1312-298 90 1313-299 87 1314-300 83 1315-298 81
1316-296 66 1317-296 63 1318-296 60 1319-296 56
1320-296 46 1321-293 41 1322-290 37 1323-287 32
1324-284 28 1325-281 23 1326-278 19 1327-275 15
1328-275 9 1329-274 5 1330-271 4 1331-271 360
1332-267 2 1333-267 357 1334-265 353 1335-264 354
1336-265 349 1337-263 344 1338-262 345 1339-262 347
1340-262 340 1341-263 336 1342-266 335 1343-265 332
1344-266 328 1345-268 328 1346-269 323 1347-270 320
1348-273 315 1349-274 313 1350-277 312 1351-279 307
1352-282 300 1353-285 296 1354-288 293 1355-291 291
1356-294 289 1357-297 285 1358-301 281 1359-304 277
1360-308 275 1361-312 269 1362-316 268 1363-321 265
1364-325 262 1365-330 259 1366-336 265 1367-344 262
1368-352 252 1369-357 252 1370-364 252 1371-375 242
1372-379 234 1373-378 234 1374-386 223 1375-386 214
1376-389 207 1377-389 203 1378-394 191 1379-398 184
1380-400 180 1381-400 184 1382-400 158 1383-400 154

1384-400	166	1385-400	147	1386-400	122	1387-400	119
1388-400	90	1389-400	69	1390-400	30	1391-400	35
1392-400	25	1393-400	16	1394-400	13	1395-400	13
1396-356	2	1397-379	356	1398-364	352	1399-358	344
1400-346	338	1401-341	334	1402-331	333	1403-323	328
1404-315	324	1405-311	325	1406-305	317	1407-299	310
1408-290	309	1409-288	304	1410-284	299	1411-283	298
1412-279	294	1413-278	289	1414-274	288	1415-275	288
1416-272	285	1417-269	282	1418-268	281	1419-265	278
1420-264	278	1421-263	271	1422-260	271	1423-259	272
1424-257	268	1425-256	267	1426-254	265	1427-253	261
1428-251	259	1429-251	257	1430-250	255	1431-249	249
1432-249	244	1433-247	241	1434-244	238	1435-244	235
1436-242	230	1437-241	226	1438-240	223	1439-239	215
1440-237	212	1441-237	207	1442-236	203	1443-234	203
1444-234	199	1445-233	193	1446-231	190	1447-231	183
1448-230	185	1449-230	181	1450-229	177	1451-228	174
1452-227	171	1453-226	167	1454-224	166	1455-224	167
1456-224	158	1457-225	152	1458-225	153	1459-224	153
1460-225	147	1461-226	145	1462-226	144	1463-227	144
1464-228	136	1465-229	130	1466-229	133	1467-230	131
1468-231	119	1469-232	119	1470-233	118	1471-236	110
1472-237	110	1473-239	106	1474-240	100	1475-241	98
1476-243	96	1477-245	93	1478-247	86	1479-249	84
1480-251	77	1481-253	76	1482-256	74	1483-259	70
1484-262	67	1485-264	59	1486-267	59	1487-268	59
1488-272	55	1489-274	52	1490-276	52	1491-278	46
1492-280	40	1493-282	40	1494-286	38	1495-289	31
1496-293	19	1497-298	24	1498-299	21	1499-308	4
1500-313	2	1501-318	356	1502-326	347	1503-333	347
1504-338	334	1505-346	326	1506-350	319	1507-353	322
1508-359	309	1509-360	301	1510-353	298	1511-354	286
1512-350	283	1513-342	281	1514-336	265	1515-332	252
1516-324	245	1517-317	243	1518-312	234	1519-305	217
1520-298	211	1521-290	210	1522-286	198	1523-279	198
1524-274	197	1525-272	190	1526-266	187	1527-260	187
1528-258	185	1529-255	178	1530-249	178	1531-246	176
1532-242	174	1533-239	172	1534-235	171	1535-232	169
1536-230	161	1537-227	157	1538-225	162	1539-223	164
1540-222	153	1541-220	143	1542-218	144	1543-216	145
1544-216	137	1545-213	135	1546-213	137	1547-211	131
1548-211	128	1549-209	129	1550-210	124	1551-209	119
1552-208	121	1553-206	122	1554-207	111	1555-207	108
1556-206	111	1557-205	109	1558-206	100	1559-207	100
1560-209	96	1561-209	93	1562-209	90	1563-209	87
1564-208	91	1565-210	91	1566-212	74	1567-210	82
1568-212	76	1569-211	73	1570-211	77	1571-214	67
1572-216	66	1573-216	68	1574-218	65	1575-219	61
1576-221	54	1577-222	57	1578-225	56	1579-227	52
1580-228	47	1581-230	50	1582-233	44	1583-234	42
1584-237	43	1585-240	37	1586-243	31	1587-246	31
1588-250	30	1589-257	19	1590-260	16	1591-263	16
1592-270	13	1593-274	3	1594-280	360	1595-288	1
1596-295	351	1597-302	348	1598-311	349	1599-319	342
1600-333	336	1601-344	335	1602-355	330	1603-367	316
1604-374	309	1605-373	299	1606-372	287	1607-357	265
1608-342	243	1609-333	228	1610-319	215	1611-306	212
1612-290	204	1613-281	198	1614-269	193	1615-260	192

1616-249 192	1617-242 186	1618=234 185	1619=226 182
1620-222 179	1621-216 173	1622=210 173	1623=206 177
1624-201 171	1625-197 170	1626=192 168	1627=187 168
1628-183 164	1629-180 162	1630=176 161	1631=173 161
1632-171 154	1633-167 154	1634=165 157	1635=162 150
1636-160 147	1637-157 150	1638=156 145	1639=153 144
1640-151 144	1641-149 146	1642=148 140	1643=146 137
1644-144 136	1645-143 138	1646=143 131	1647=141 127
1648-140 131	1649-139 137	1650=139 124	1651=137 122
1652-136 124	1653-137 120	1654=137 119	1655=137 120
1656-137 115	1657-136 114	1658=135 115	1659=135 112
1660-136 109	1661-136 106	1662=138 108	1663=140 110
1664-140 106	1665-141 102	1666=142 101	1667=143 101
1668-145 99	1669-146 98	1670=148 98	1671=149 92
1672-151 90	1673-152 90	1674=155 89	1675=157 88
1676-160 86	1677-163 84	1678=166 83	1679=169 81
1680-173 81	1681-177 78	1682=181 72	1683=185 72
1684-190 72	1685-196 68	1686=202 63	1687=208 63
1688-215 57	1689-222 52	1690=230 49	1691=239 45
1692-249 38	1693-257 21	1694=266 12	1695=272 357
1696-275 347	1697-271 337	1698=261 329	1699=253 321
1700-241 313	1701-230 305	1702=218 299	1703=208 295
1704-196 289	1705-189 282	1706=180 280	1707=171 277
1708-163 275	1709-157 271	1710=150 266	1711=143 265
1712-137 266	1713-132 264	1714=126 259	1715=121 258
1716-115 255	1717-110 255	1718=105 253	1719=101 251
1720 -97 250	1721 -93 249	1722 -88 244	1723 -85 244
1724 -79 243	1725 -75 243	1726 -72 242	1727 -69 241
1728 -66 240	1729 -63 238	1730 -59 237	1731 -56 236
1732 -53 235	1733 -50 233	1734 -48 232	1735 -44 232
1736 -41 231	1737 -39 229	1738 -36 228	1739 -34 227
1740 -32 228	1741 -28 227	1742 -26 225	1743 -24 225
1744 -21 225	1745 -19 225	1746 -17 224	1747 -15 224
1748 -13 223	1749 -11 222	1750 -10 222	1751 -8 224
1752 -5 219	1753 -3 220	1754 -2 222	1755 -1 216
1756 0 215	1757 2 217	1758 4 217	1759 5 217
1760 6 217	1761 8 218	1762 9 214	1763 12 220
1764 12 222	1765 13 218	1766 14 211	1767 15 212
1768 17 210	1769 18 210	1770 18 212	1771 20 212
1772 21 213	1773 22 212	1774 23 211	1775 24 215
1776 25 209	1777 26 206	1778 27 211	1779 28 212
1780 29 208	1781 29 208	1782 30 212	1783 30 211
1784 31 206	1785 32 206	1786 33 210	1787 33 208
1788 34 207	1789 35 208	1790 35 208	1791 34 208
1792 34 206	1793 35 207	1794 36 204	1795 36 206
1796 37 209	1797 37 204	1798 37 203	1799 38 205

MATCHED FILTER

PROGRAM AG2

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MATCHED FILTER
PROGRAM AG2
DOCUMENTATION

1. GENERAL

This exhibit is a documentation of Electronic Data Processing (EDP) Program AG2, Matched Filter Program, produced under contract AF30(602)-67-C-007 for RADC by the Fort Worth Division of General Dynamics. EDP program AG2 was originally written for use with an IBM 360 system; however, in this documentation the necessary changes have been incorporated to make the program compatible with the GE625/635 computer at RADC. This documentation has been prepared in accordance with Electronic Data Processing (EDP) Programs and Program Documentation, Requirements for Preparation of, Exhibit RADC-3010 of 17 January 1964.

2. ABSTRACT

The purpose of this procedure is the computation of a set of correlation coefficients ρ (D,θ) the magnitude of which are an indication of the probability that a scattering center is located at the polar coordinates (D,θ). The library data processed by this procedure consists of cross section and absolute phase data obtained from magnetic tapes produced by procedure A24. The output of AF2 is a listing of the magnitudes of ρ (D,θ) as a function of discrete values of D and θ. Any portion of the library data can be selected as input by adjusting the problem data.

3. MACHINE DEFINITION

The program was originally written for use with an IBM 360 computer system. The enclosed documentation is in Fortran IV language and is

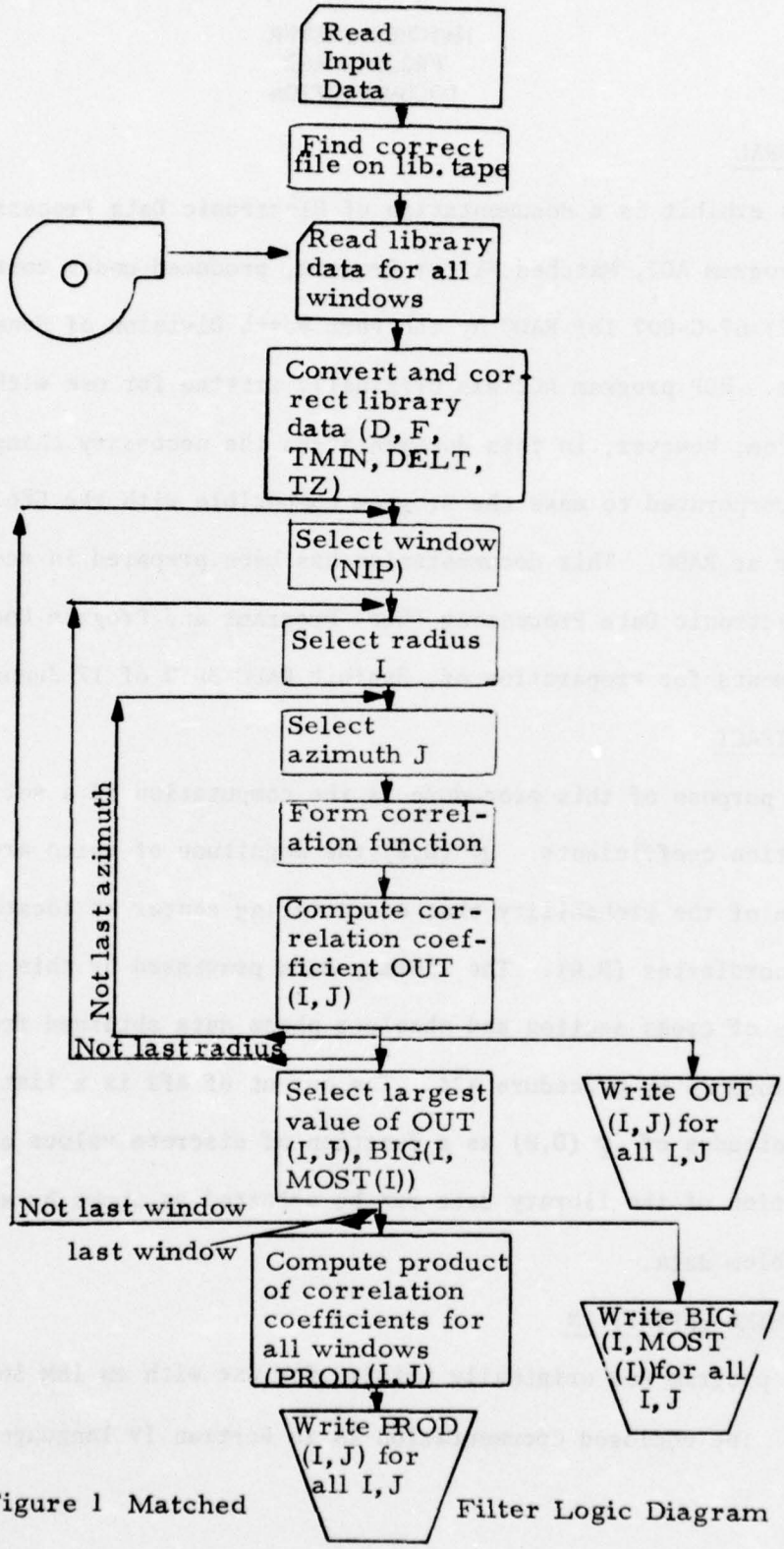

Figure 1 Matched Filter Logic Diagram

specifically designed for use with the GD625/635 computer at RADC.

4. PROGRAM DESCRIPTION

Figure 1 contains a simplified logic diagram of AG2. Basically the program performs the following functions:

1. Calls the problem
2. Selects the correct file on the library tape
3. Reads the library data for all windows
4. Computes the correlation coefficients for all windows
5. Computes the product of the correlation coefficients for selected windows.

5. INSTRUCTIONS TO CUSTOMER

5.1 Input Data

1. Library Data. Library tapes for procedure AG2 are produced by procedure A24. These tapes are identified by a label of the form XXXXXXANN where XXXXXX is the job number under which the tape is produced, A is an alphabetic character, and NN is a sequence number.

2. Problem Data

a. Identification Format

Columns	
63-68	Job Number
69	"p"
70-72	Deck number
73-77	Card sequence number
78-80	AG2

b. Input Parameters

F	Frequency (GHz)
TMIN	Initial target aspect angle
DELT	Target aspect angle increment
L	No of input aspect angles (Total encompassed by all windows)
PHIM	Minimum output geometry angle
DELP	Output geometry angle
N	No of output geometry angles (az)
YMIN	Minimum dimension parameter
M	No of output dimension parameters (radians)
DELY	Dimension parameter increment
MI(KK)	Minimum aspect for KKth interval
MA(KK)	Maximum aspect for KKth interval
NIP	No of aspect windows
D	Residual radius arm in input phase data
TZ	Angle formed by D
NR	No of files to be processed
ISTEP	Correlation increment = 1,2,5,10 or 20 only
NFILE	No of files on tape
IFD	Field on library tape where first aspect angle is located
IFN	File number being processed

c. Card Formats (AG2)

(i) First card of each problem deck

Card Cols	1-4
Data	NR

(ii) Second card of each problem deck

Card Cols	1-10	11-20	21-30	31-40	41-50	51-60	61-64	65-66
Data	L	M	N	TMIN	YMIN	PHIM	N FILE	IFD

(iii) Third card of each problem deck

Card Cols	1-10	11-20	21-30	31-40	41-50	51-60	61-62	63-64	65-66
Data	F	DELT	DELY	DELP	D	TZ	IFN	NIP	ISTEP

All input items except those beginning with the letters I,J,K, L,M or N must contain a decimal point and may contain an exponent (power of ten by which the number is multiplied) in the right most columns of its field. The exponent may be omitted if the last column of the field is blank. When input the exponent is preceded by its sign or the character E and conains no decimal point. Items beginning with the letters I, J, K, L, M or N must be right adjusted to their respective fields.

5.2 Output Data

1. Output Parameters

The output of this procedure is a listing of the magnitude of the following quantities:

OUT (I,J) Correlation coefficient for single windows where I corresponds to radius and J to azimuth of the computer scattering center.

BIG(I,J) Maximum values of OUT(I,J) for each I occurring when J = MOST(I)

PROD(I,J) Normalized Product of values of OUT(I,J) for each window.

The location R (radius in inches) of a scattering center is computed from the value of I using the equation

R = YMIN + (I-1) * DELY

The azimuth angle of a scattering center is computed using the equation

PHAS (J) = PHIM + (J-1) * DELP

2. Output Format

(i) Window #1

(A1) I BIG (I,MOST(I)) MOST(I)

continue for I=1,M

(A2) I=1 OUT(1,J) for J=1,N

I=2 OUT(2,J) for J=1,N

...

continue for I=1,M

(A3) I=1 PROD(1,J) for J=1,N

I=2 PROD(2,J) for J=1,N

continue for I=1,M

NOTE: In this case only PROD(I,J) = OUT(I,J) since only one window is used.

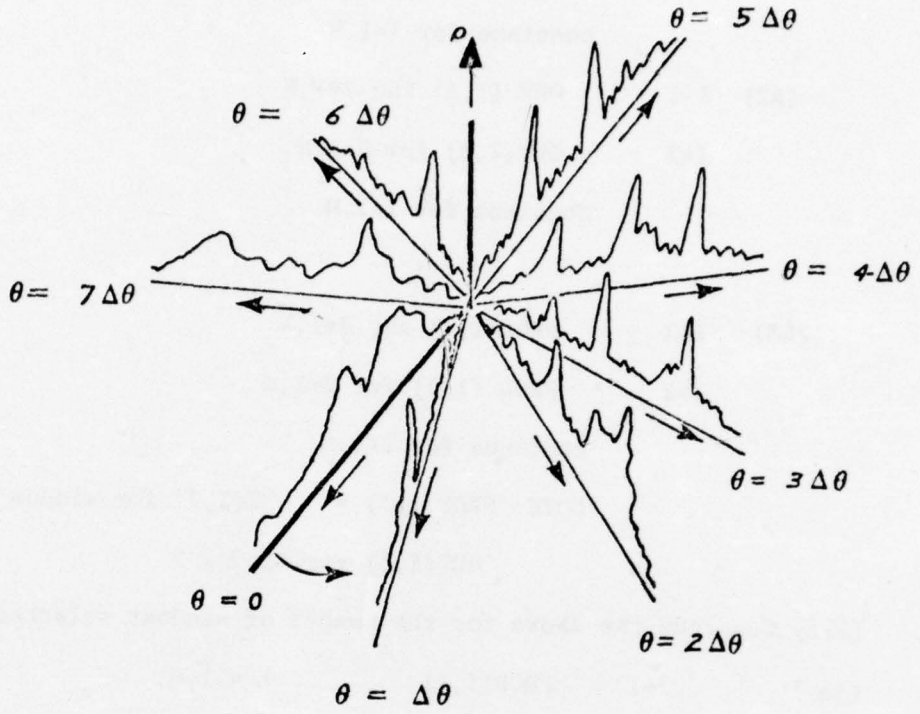

Fig. 2 Polar Plot of (R,θ) for Discrete Values of θ

(ii) Window #2

(A1) I BIG (I,MOST(I)) MOST(I)

continue for I=1,M

...

(A2) I-1 OUT (1,J) for J=1,N

I=2 OUT(2,J) for J=1,N

continue for I=1,M

...

(A3) I=1 PROD(1,J) for J=1,N

I=2 PROD (1,J) for J=1,N

continue for I=1,M

NOTE: PROD(I,J) = OUT(I,J) for window 1 *

OUT(I,J) for window 2

(iii) Continue the above for the number of windows selected.

(iv) J=1 PROD(I,1) I = 1,M

J=2 PROD(I,2) I=1,M

Continue for J=1,N

The last two lists of PROD(I,J) represent identical data; however, the first is an azimuth cut and the second is a cut along a given radius. Figure 2 shows typical values of plotted in polar coordinates.

5.3 Time Estimate. Approximately 3 minutes are required to run one problem using four windows of 20° each.

```
C       MATCHED FILTER PROGRAM
        DIMENSION SIGR(3600),SIGM(3600),SIGP(3600),OUT(100,180),IGM(3600),
       1IGP(3600),BIG(200),MOST(100),                          IDOU(3)  ,
       2   MI(20),  MA(20) ,KZ(3600)   ,PHAS(360),PRO(100,180)
      1 IIFN = 0
        CALL FLGEOF( 8 , IEOF)
        IIFN = 0
        READ (5,300) NR
  300 FORMAT  (I4)
        DO 60  NF=1,NR
         WRITE (6,2)
    2   FORMAT(19H1 INPUT DATA VALUES)
        READ (5,3)  L,M,N,TMIN,YMIN,PHIM,NFILE,IFD
    3 FORMAT (3I10,3F10.3,I4,I2)
        READ (5,301)  F,DELT,DELY,DELP,D,TZ,IFN,NIP,ISTEP
  301 FORMAT (6F10.3,3I2)
        DELPD = DELP
        IFILE = IFN
        DO 400  I=1,N
        DO 400  J=1,N
 4 00 PRO(I,J) = 1.0
        DO 302 KK=1,NIP
  302 READ (5,303)  MI(KK), MA(KK)
  303 FORMAT (2I5)
        WRITE  (6,3)  L,M,N,TMIN,YMIN,PHIM,NFILE,IFD
        WRITE  (6,301)  F,DELT,DELY,DELP,D,TZ,IFN,NIP,ISTEP
        WRITE  (6,300)  NR
        DO  304  KK=1,NIP
  304 WRITE  (6,303)   MI(KK), MA(KK)
        IF (ISTEP.EQ.1)  GO TO 700
        IF (ISTEP.EQ.2)  GO TO 700
        IF (ISTEP.EQ.5)  GO TO 700
        IF (ISTEP.EQ.10)  GO TO 700
        IF (ISTEP.EQ.20)  GO TO 700
        WRITE  (6,701)  ISTEP
  701 FORMAT  (21H THE VALUE OF ISTEP, ,I2,26H, IS NOT ACCEPTABLE TO AG2
       D)
        GO TO 60
  700 IFN = IFN - IIFN
        XXIFN = IFN - 1
        NSKIP = (TMIN + 180.0)/0.2 + 903.*XXIFN + 2.
        FREQ =(2.*3.14159*F*10.**9)/3.0E+8
         RPD = 3.14159/180.0
         TMIN = TMIN*RPD
         PHIM = PHIM*RPD
         DELT = DELT*RPD
         DELP = DELP*RPD
         YMIN = 0.0254*YMIN
         DELY = 0.0254*DELY
         D = 0.0254*D
         TZ = TZ*RPD
        KTE = 1
```

```
      IF(IFILE .EQ. IIFN)GO TO 33
       DO 8  K = 1,NSKIP
      READ(8,4)
      IF(IEOF .EQ. 0)GO TO 8
    4  FORMAT(1X)
      IEOF = 0
    8  CONTINUE
      KTE = 1
      JZ = 1
      IF (IFD.EQ.1)  GO TO 12
      IF (IFD.NE.2)  GO TO 601
      JZ = 4
      READ (8,600)  IGM(1),IGP(1),IGM(2),IGP(2), IGM(3),IGP(3),IDOU
  600 FORMAT (14X,6X,2I4,6X,2I4,6X,2I4,6X,I6,1HP,I3,I5,3HA24)
      WRITE (6,600)  IGM(1),IGP(1),IGM(2),IGP(2),IGM(3),IGP(3),IDOU
      GO TO 12
  601 IF (IFD.NE.3)  GO TO 603
      JZ = 3
      READ  (8,602)  IGM(1),IGP(1),IGM(2), IGP(2),IDOU
  602 FORMAT (28X,6X,2I4,6X,2I4,6X,I6,1HP,I3,I5,3HA24)
      WRITE (6,602)  IGM(1),IGP(1),IGM(2),IGP(2),IDOU
      GO TO 12
  603 IF (IFD.NE.4)  GO TO 12
      JZ = 2
      READ  (8,604)  IGM(1),IGP(1),IDOU
  604 FORMAT (42X,6X,2I4,6X,I6,1HP,I3,I5,3HA24)
      WRITE (6,604)  IGM(1),IGP(1),IDOU
   12 JZZ = L+1
      DO 32  K=JZ,JZZ,4
      READ (8,13) IGM(K),IGP(K),IGM(K+1),IGP(K+1),IGM(K+2
     D),IGP(K+2),IGM(K+3),IGP(K+3),IDOU
      IF(IEOF .EQ. 0)GO TO 1333
      IEOF = 0
      GO TO 14
   13 FORMAT (6X,2I4,6X,2I4,6X,2I4,6X,2I4,6X,I6,1HP,I3,I5,3HA24)
 1333 IF (KTE .GT. 10) GO TO 16
      WRITE  (6,13)  IGM(K),IGP(K),IGM(K+1),IGP(K+1),IGM(K+2),IGP(K+2),
     D IGM(K+3),IGP(K+3),IDOU
      GO TO 16
   14 IF (KTE.GT.10)  GO TO 16
      WRITE  (6,15)  IGM(K),IGP(K),IGM(K+1),IGP(K+1),IGM(K+2),IGP(K+2),
     D IGM(K+3),IGP(K+3),IDOU
   15 FORMAT(1X,8HERROR 08/6X,2I4,6X,2I4,6X,2I4,6X,2I4,6X,I6,1HP,I3,I5,
     D 3HA24)
   16 KTE = KTE+1
   32 CONTINUE
   33 KZ(1) = 0
      KZZ = 1
   54  DO 148  K=1,L,ISTEP
      SIGP(KZZ)=FLOAT(IGP(K))*RPD
      EXP = (FLOAT(IGM(K)))/200.0
      VALUE = 10.0**EXP
```

```
      XXXK = K-1
      SIGP(KZZ) = SIGP(KZZ)+2.0*D*FREQ*COS(TMIN+ XXXK *DELT + TZ)
      SIGR(KZZ)=VALUE * COS(SIGP(KZZ))
      SIGM(KZZ)=VALUE * SIN(SIGP(KZZ))
  148 KZZ = K + ISTEP - ((KZZ)*(ISTEP-1))
      DO 161  IP = 1,NIP
      MIN = (TMIN/RPD)*10.0
      KXX1 = ( MI(IP)- MIN)/ISTEP+1
      KXX2 = ( MA(IP)- MIN)/ISTEP+1
       DO  150  I = 1,M
      XXXI = I -1
       B = 2.0*FREQ*(YMIN + XXXI * DELY)
       DO 150  J =1,N
      XXXJ = J -1
       PHI = PHIM + XXXJ * DELP
       PHAS(J) = -(PHIM + XXXJ * DELPD) + 180.
      IF (PHAS(J).LT.0.)  PHAS(J) = PHAS(J) + 360.
      SUM1 = 0.0
      SUM2 = 0.0
      DO 149  K=KXX1,KXX2
       XXXK = K -1
      XISTEP = ISTEP
       ARG = COS( TMIN + XXXK*XISTEP *DELT + PHI)
      FILTR  = COS(B*ARG)
      FILTI  = SIN(B*ARG)
      SUM1 = SUM1 + SIGR(K)*FILTR + SIGM(K)*FILTI
  149 SUM2 = SUM2 + SIGM(K)*FILTR - SIGR(K)*FILTI
      OUT(I,J) = SQRT(SUM1**2 + SUM2 **2)
      PRO(I,J) = OUT(I,J) * PRO(I,J)
  150  CONTINUE
      DO 151  I=1,M
      BIG(I) = OUT(I,1)
      MOST(I) = 1
      DO 151  J=2,N
      IF ( OUT(I,J).LE.BIG(I)) GO TO 151
      BIG(I) = OUT(I,J)
      MOST(I) = PHAS(J)
  151 CONTINUE
       FXX1 = FLOAT(MI(IP))/10.0
       FXX2 = FLOAT(MA(IP))/10.0
      WRITE (6,153) IP,FXX1,FXX2
  153 FORMAT  (10H  WINDOW  ,I4,1X,F7.3,2X,2HTO,2X,F7.3)
      WRITE (6,154) (I,BIG(I),MOST(I),I=1,M)
  154 FORMAT (1H0,18HMAX AND MIN VALUES/,(I4,1E2[illegible].7,I8))
      DO 159  I = 1,M
      WRITE (6,155)  I, (OUT(I,J), PHAS(J),J=1,N)
  155 FORMAT (1H0,2HI=,I3,/,(5(E13.7,2X,F4.0,2X)))
  159 CONTINUE
      WRITE (6,932) IP
  932 FORMAT (1H0,35HTHE FOLLOWING ARRAY IS PRO(I,J) FOR,I5, 7HWINDOWS)
      DO 1161 I =1,M
      WRITE (6,155)  I, (PRO(I,J), PHAS(J),J=1,N)
```

```
1161 CONTINUE
     IF(IP .NE. NIP)GO TO 161
     DO 1162 J = 1,N
1162 WRITE(6,1155) PHAS(J), (PRO(I,J), I =1,M)
1155 FORMAT (1H0,8HPHAS(J)=,F4.0,/,10(3X,E10.4))
 161 CONTINUE
     IF(IFILE .EQ. IIFN)GO TO 58
     DO 160 IAC=1,503
 160 READ(8, 4)
     IF(IEOF .EQ. 1)IEOF = 0
  58 IIFN = IFILE
  60 CONTINUE
     GO TO 1
     END
```

```
    1          1
    2               505          17          90        10.0         0.0         0.0  18  1
STATEMENT LABEL MUST BE BETWEEN 1 AND 99999
. IS ILLEGAL AS THE FIRST CHARACTER OF A STATEMENT
    3              5.975        0.10         1.0         4.0         0.0         0.0  1 310
    4          100  300
STATEMENT LABEL MUST BE BETWEEN 1 AND 99999
    5          250  450
STATEMENT LABEL MUST BE BETWEEN 1 AND 99999
    6          400  600
STATEMENT LABEL MUST BE BETWEEN 1 AND 99999
'STOP' STATEMENT IS MISSING-SIMULATED
'END' STATEMENT MISSING-SIMULATED
```

8. SAMPLE PROBLEMS

8.1 Description. A sample problem is included for checking out program AG2.

8.2. Input Data. The input data used for the sample problem is shown on the following page. Any portion of the library data can be selected as input by adjusting the problem data. The input data is explained in Section 5.1.

```
4
        3405          27          90       -170.0         0.0         0.0   12 1
        5.95        0.10         1.0         4.0         0.0         0.0 2 410
 700-1500
-1550-1350
-1400-1200
-1250-1050
        3405          27          90       -170.0         0.0         0.0   12 1
        5.95        0.10         1.0         4.0         0.0         0.0 2 410
 -750 -550
 -600 -400
 -450 -250
 -300 -100
        3405          27          90       -170.0         0.0         0.0   12 1
        5.95        0.10         1.0         4.0         0.0         0.0 2 410
  100  300
  250  450
  400  600
  550  750
        3405          27          90       -170.0         0.0         0.0   12 1
        5.95        0.10         1.0         4.0         0.0         0.0 2 410
 1050 1250
 1200 1400
 1350 1550
 1500 1700
/*
```

CC = 9026

8.3 Output Data. The output from Procedure AG2 for the sample problem is given on the following pages.

```
 INPUT DATA VALUES
     3405          27          90   -170.000        0.0          0.0     12 1
    5.950       0.100       1.000       4.000        0.0          0.0    2 410
   4
-750 -550
-600 -400
-450 -250
-300 -100
 WINDOW      1            -75.000   TO  -55.000

MAX AND MIN VALUES
   1        0.2154750E 01        1
   2        0.2161719E 01      112
   3        0.2157113E 01      112
   4        0.2170906E 01      112
   5        0.2173096E 01      112
   6        0.2173677E 01      112
   7        0.2172664E 01      112
   8        0.2170066E 01      112
   9        0.2165906E 01      112
  10        0.2160215E 01      112
  11        0.2153029E 01      112
  12        0.2144399E 01      112
  13        0.2134377E 01      112
  14        0.2123020E 01      112
  15        0.2110391E 01      112
  16        0.2096560E 01      112
  17        0.2081605E 01      112
  18        0.2065608E 01      112
  19        0.2048652E 01      112
  20        0.2030815E 01      112
  21        0.2012197E 01      112
  22        0.1992885E 01      112
  23        0.1972970E 01      112
  24        0.1952545E 01      112
  25        0.1931688E 01      112
  26        0.1910500E 01      112
  27        0.1889054E 01      112

I=  1

.2154750E 01  180.  0.2154750E 01  176.  0.2154750E 01  172.

.2154750E 01  160.  0.2154750E 01  156.  0.2154750E 01  152.

.2154750E 01  140.  0.2154750E 01  136.  0.2154750E 01  132.

.2154750E 01  120.  0.2154750E 01  116.  0.2154750E 01  112.

.2154750E 01  100.  0.2154750E 01   96.  0.2154750E 01   92.
```

0.2154750E 01	168.	0.2154750E 01	164.
0.2154750E 01	148.	0.2154750E 01	144.
0.2154750E 01	128.	0.2154750E 01	124.
0.2154750E 01	108.	0.2154750E 01	104.
0.2154750E 01	88.	0.2154750E 01	84.

```
PHAS(J1=212.
  0.3096E 02    0.5463E 02    0.1625E 02    0.1597E 01    0.6373E 00
  0.1787E-01    0.8073E-02    0.2897E-02    0.5987E-02    0.4872E-03
  0.3995E-03    0.4592E-03    0.2001E-03    0.2512E-03    0.2764E-03

PHAS(J1=208.
  0.3096E 02    0.5407E 02    0.1718E 02    0.2088E 01    0.6112E 00
  0.5215E-01    0.1049E-01    0.1148E-02    0.6305E-02    0.3722E-03
  0.3418E-03    0.9716E-03    0.1990E-03    0.1264E-03    0.4493E-03

PHAS(J1=204.
  0.3096E 02    0.5348E 02    0.1836E 02    0.2724E 01    0.6060E 00
  0.5340E-01    0.6025E-02    0.1531E-02    0.2288E-02    0.5444E-03
  0.3144E-03    0.5120E-03    0.2611E-03    0.2166E-03    0.3212E-03

PHAS(J1=200.
  0.3096E 02    0.5285E 02    0.1976E 02    0.3523E 01    0.5831E 00
  0.1838E-01    0.8059E-02    0.4257E-02    0.9291E-02    0.3199E-03
  0.6067E-03    0.7395E-03    0.1672E-03    0.1688E-03    0.3117E-03

PHAS(J1=196.
  0.3096E 02    0.5213E 02    0.2137E 02    0.4498E 01    0.1001E 01
  0.1510E 00    0.3819E-02    0.3142E-02    0.8690E-02    0.3636E-02
  0.1007E-03    0.6538E-03    0.6502E-03    0.4007E-03    0.7576E-04

PHAS(J1=192.
  0.3096E 02    0.5127E 02    0.2313E 02    0.5649E 01    0.1687E 01
  0.3810E 00    0.5823E-01    0.2412E-02    0.1625E-02    0.7145E-02
  0.4555E-04    0.2609E-03    0.1342E-03    0.3411E-03    0.7958E-03

PHAS(J1=188.
  0.3096E 02    0.5025E 02    0.2499E 02    0.6967E 01    0.2757E 01
  0.8598E 00    0.1332E 00    0.2329E-01    0.4096E-02    0.2030E-02
  0.1189E-03    0.3858E-03    0.3446E-03    0.1647E-03    0.1616E-03

PHAS(J1=184.
  0.3096E 02    0.4903E 02    0.2684E 02    0.8428E 01    0.4156E 01
  0.1136E 01    0.2196E 00    0.2370E-01    0.5745E-01    0.3771E-02
  0.4158E-03    0.6120E-04    0.2192E-03    0.1229E-03    0.1977E-03
```

0.4210E 00 0.2688E 00 0.1257E 01 0.4293E 00 0.1355E 00
0.2854E-03 0.5643E-03 0.2423E-04 0.3580E-03 0.6101E-03
0.9219E-04 0.5578E-03

0.4435E 00 0.1547E 00 0.1421E 01 0.1001E 01 0.4576E-01
0.8961E-03 0.3545E-03 0.3134E-06 0.6135E-03 0.2709E-03
0.1189E-03 0.4067E-03

0.4624E 00 0.8211E-01 0.1336E 01 0.1678E 01 0.1775E 00
0.8896E-03 0.1093E-02 0.2787E-05 0.2366E-03 0.5506E-03
0.1350E-03 0.2604E-03

0.5011E 00 0.1362E 00 0.9683E 00 0.2213E 01 0.6159E 00
0.2990E-03 0.1702E-02 0.5947E-04 0.8835E-05 0.2658E-03
0.3160E-03 0.2556E-03

0.5914E 00 0.1902E 00 0.4421E 00 0.2252E 01 0.1296E 01
0.4040E-03 0.1412E-03 0.2705E-03 0.3098E-03 0.3281E-04
0.7939E-04 0.8853E-03

0.7324E 00 0.2352E 00 0.1221E 00 0.1605E 01 0.1911E 01
0.4107E-02 0.1146E-02 0.6600E-05 0.6569E-03 0.2206E-03
0.1106E-03 0.1520E-03

0.9119E 00 0.3321E 00 0.3048E 00 0.5973E 00 0.1848E 01
0.3214E-02 0.5870E-02 0.1907E-02 0.1706E-03 0.6675E-04
0.2857E-03 0.1196E-03

0.1315E 01 0.5127E 00 0.4649E 00 0.2407E 00 0.9534E 00
0.3229E-03 0.5269E-02 0.3929E-02 0.1272E-02 0.2233E-02
0.1067E-02 0.4019E-03

SECTION VI

POLARIZATION SIGNATURE TECHNIQUE PROGRAM AG3

TABLE OF CONTENTS

POLARIZATION SIGNATURE TECHNIQUE
PROGRAM AG 3
DOCUMENTATION

1. GENERAL

This exhibit is a documentation of Electronic Data Processing (EDP) Program AG3, Polarization Signature Technique Program, produced under contract AF30(602)-67-C-0074 for RADC by the Fort Worth division of General Dynamics. EDP program AG3 was originally written for use with an IBM 360 system; however, in this documentation the necessary changes have been incorporated to make the program compatible with the GE 625/635 computer at RADC. This documentation has been prepared in accordance with Electronic Data Processing (EDP) Programs and Program Documentations, Requirements for Preparation of, Exhibit RADC-3010 of 17 January 1964.

2. ABSTRACT

The purpose of this procedure is the computation of average polarization signature ratios RHOH1 and RHOHq and the computation of the absolute location in space of the phase centers of a vehicle. The library data processed by this procedure consists of target scattering matrix data obtained from magnetic tapes produced by procedure A81. The output of AG3 is a listing of the magnitudes of RHOL1 and RHOL2 and a plot of RHOH1 and RHOH2 as a function of the target aspect angle and a plot of the absolute phase of a vehicle as a function of aspect angle. The computation of the absolute location of the phase center is a subroutine of the polarization signature program.

3. MACHINE DEFINITION

The program was originally written for use with an IBM 360 computer system. The enclosed documentation is in Fortran IV language and is specifically designed for use with the GE 625/635 computer and the EAI plotter at RADC. A magnetic tape is produced by the GE 625/635 and is then run on the EAI plotter to produce a plot.

4. PROGRAM DESCRIPTION

Program AG3 is divided into a main program and five subroutines: PLTPOL, PLTPHA, SKIPF, PHASE and ERROR. These divisions are described below.

4.1. Main Program. The main program performs the following functions:

1. Calls the problem
2. Reads the library data for the target scattering matrix

3. Computes the radar cross section at a set of selected polarizations (P) and forms the ratio:

$$\text{Ratio} = \frac{|\sigma(e,\theta) - \sigma(e + \pi/2, \theta)|}{|\sigma(e,\theta) + \sigma(e + \pi/2, \theta)|}$$

4. Selects the polarizations RHOH1 and RHOH2 between which the ratio is greater than a prescribed threshold level

5. Averages the volume of RHOL1 and RHOL2 over a set of NN aspect angles to produce averages RHOH1 and RHOH2

Figure 1 contains a logic diagram of the main program.

4.2 Subroutine PLTPOL. This subroutine is used to plot RHOH1 and RHOH2 as a function of aspect angle. GE 635 subroutines LINE, NUMBER and STDBY are called in this subroutine.

4.3 Subroutine PLTPHA. This subroutine is used to plot the absolute phase in radians vs aspect angle. GE 635 subroutines LINE, NUMBER and STDBY are called in this subroutine.

4.4 Subroutine SKIPF. This subroutine is used to select the correct file on the library input tape.

4.5 Subroutine PHASE. This subroutine computes the absolute location in space of the phase center of a vehicle. Figure 2 shows a logic diagram of this subroutine.

4.6 Subroutine ERROR. This subroutine is used to print out error messages.

5. INSTRUCTIONS TO CUSTOMER

5.1 Input Data

1. Library Data. Library tapes for procedure AG3 are produced by procedure A81. These tapes contain scattering matrix data - one matrix per cord image - in cord image form. Each target file (not a tape file) contains six identification records and 3,600 data records.

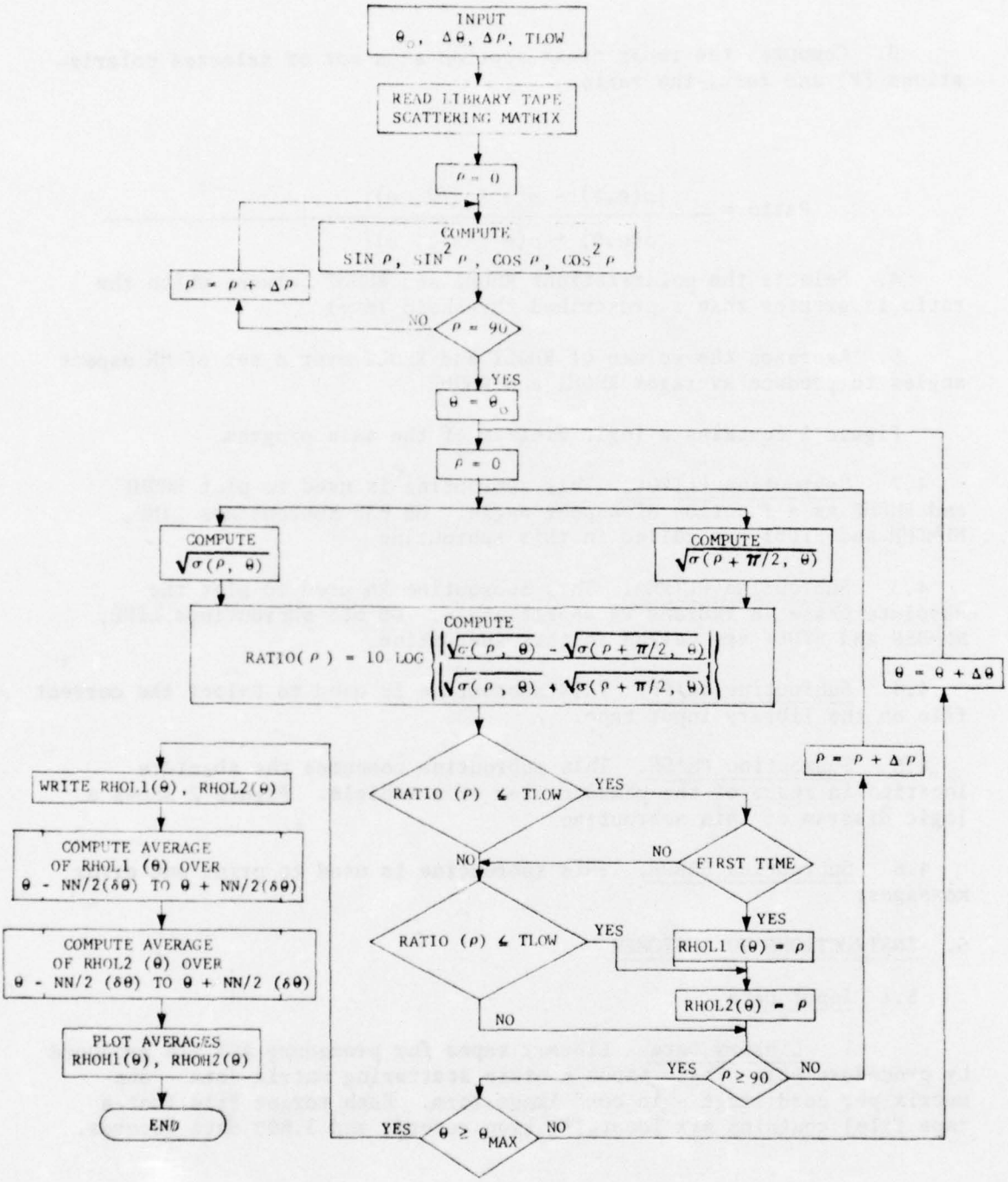

Fig. 1 LOGIC DIAGRAM OF PROGRAM AG

2. Problem Data

a. Identification Format

Columns

63 - 68	Job number
69	"P"
70 - 72	Deck number
73 - 77	Cord sequence number
78 - 80	AG3

b. Input Parameters

NN	Number of aspect angles over which RHOH is overaged
IOP1	= 0 If VH equal 0 = 1 If VH not equal 0
IOP3	= 0 NO polarization plot = 1 Call PLOT
IOP4	Dummy variable used in GD plot routines
IREC	Starting record; must be 1, 2, 5, 10 or greater
NR	Number of files to be processed
L	Number of aspect angles to be processed
INC	Theta increment x 10
DRHO	Delta rho: polarization increment
LP	Print out increment for library data
LIM1	Lower limit for end around test for phase
LIM2	Upper limit for end around test for phase

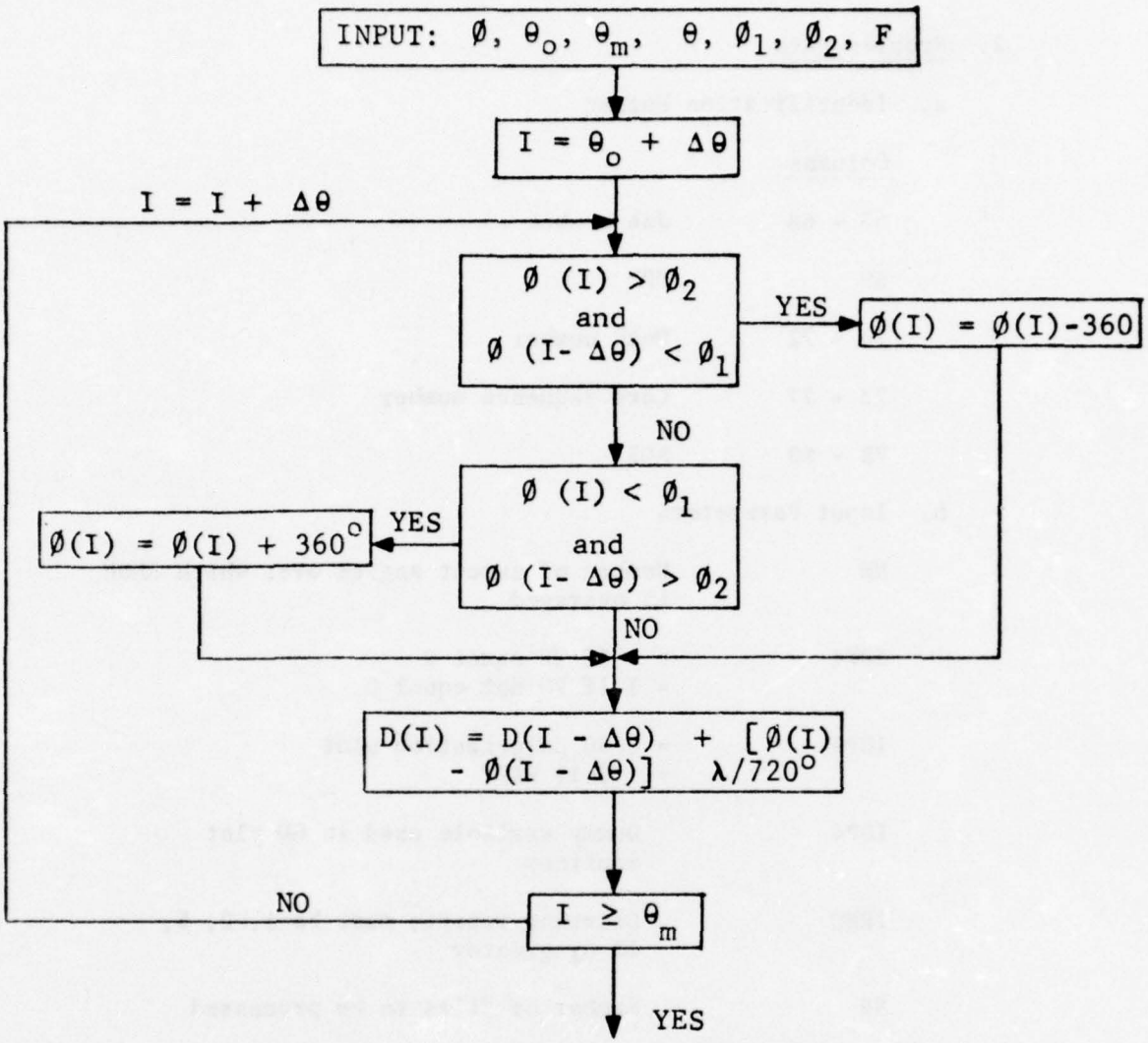

Figure 2 PHASE SUBROUTINE FLOW DIAGRAM

F	Frequency in gigahertz (= 0. for no phase)
TLOW	Threshold level for polarization comparison
LPRO	Print out increment for polarization ratio
LPTH	Print out increment for theta
NFILE	Number of files on tape
IFN(I)	File number for problem number I
HDG	28 column aplanumeric heading data

c. Cord Formats

(i) First cord of each problem deck

Cord Cols.	1-10	11-20	21-30	31-40	41-50	51-60
Data	IOP1	IOP2	IREC	NR	L	INC

(ii) Second cord of each problem deck

Cord Cols.	1-10	11-20	21-30	31-40	41-50	51-60
Data	DRHO	LP	LIM1	LIM2	F	NFILE

(iii) Third cord of each problem deck

Cord Cols.	1-10	11-20	21-30	31-40	41-50	51-60	61	62
Data	NN	TLOW	LPRO	LPTH	IRMI	IRMA	IOP3	IOP4

(iv) Fourth cord of each problem deck

Cord Cols.	1-2	3-10	11-[illegible]
Data	IFN(I)	BLANK	HDG(II), II = 1, 7

All input items except those beginning with the letters with the letters I, J, K, L, M or N must contain a decimal point and may contain an exponent (power of ten by which the number is multiplied) in the right most columns of its field. The exponent may be omitted if the last column of the field is blank. When input the

exponent is preceded by its sign or the character E and contains no decimal point. Items beginning with the letters I, J, K, Lm M or N must be right adjusted in their respective fields.

5.2 Output Data. The output of this procedure consists of:

1. RHOL1, RHOL2 — Polarization signature ratios. These are listed in the output.

2. RHOH1, RHOH2 — Averaged values of RHOL1 and RHOL2 over a set of NN aspect angles. These values are plotted vs aspect angle on the EAI plotter.

3. A plot of the absolute phase of the target in radians vs aspect angle

5.3 Time Estimate. Approximately eight minutes are required to run one problem using AG3.

```
C      POLARIZATION SIGNATURE TECHNIQUE PROGRAM
C
       COMMON/BLOK/NEOR,NSKIP,RHOH1(4000),RHOL1(4000),RHOH2(4000),RHOL2
      1(4000),IOP1,IOP2,IREC,NR,L,INC,DRHO,LP,LIM1,LIM2,F,NFILE,K,XR,SHH,
      1 LL,RPD,KOP1,MIN,MAX,J,SVV,XI,VVR,TJVV,TJHH,COSVV,VVI,SINVV,COSHH,
      2 SINHH,HHR,HHI,SIGR,SIGI,PERR,PERI,SUM,DENOM1,DENOM2,TJVH,SVH,
      3 COSVH,SINVH,VHR,VHI,XLAMDA,IFN(20),HDG(7),IX(2),IY(2),
      4 IVV(4000),JVV(4000),IVH(4000),JVH(4000),IHH(4000),JHH(4000),
      5 SINSQ(3600),COSSQ(3600),SICOS(3600),RATIO(3600),IRMI,IRMA
      6,RATIOH(4000),LPTH,IH1(2),IL1(2),IH2(2),IL2(2),IYH(2),NEOF
C **       A81  LIBRARY  TAPE  MOUNTED  ON  UNIT    8
C       NN   =    NUMBER OF ASPECT ANGLES  OVER WHICH  RHOH IS AVERAGED
C       IOP1     =    0  IF  VH .EQ. 0  **    =    1  IF  VH .NE. 0
C       IOP3     =    0  NO POLARIZATION PLOT ** = 1  CALL PLTOP
C       IREC     =    STARTING RECORD * MUST BE 1,2,5,10, OR GREATER
C       NR       =    NUMBER OF FILES TO BE PROCESSED
C       L        =    NUMBER OF ASPECT ANGLES TO BE PROCESSED
C       INC      =    THETA INCREMENT    X10
C       DRHO     =    DELTA RHO  ** POLARIZATION INCREMENT
C       LP       =    PRINT OUT INCREMENT FOR  LIBRARY DATA
C       LIM1     =    LOWER LIMIT FOR END AROUND TEST FOR PHASE
C       LIM2     =    UPPER LIMIT FOR END AROUND TEST FOR PHASE
C       F        =    FREQUENCY IN  GIGIHERTZ  (= 0. FOR NO PHASE)
C       TLOW     =   THRESHOLD LEVEL FOR POLARIZATION COMPARISON
C       LPRO     =   PRINT OUT INCREMENT FOR POLARIZATION **RATIO**
C       LPTH     =   PRINT OUT INCREMENT FOR THETA
C       NFILE    =    NUMBER OF FILES ON TAPE
C       IFN(I)   =   FILE NUMBER FOR PROBLEM NUMBER  *I*
C       HDG      =   28 COLUMN APLANUMERIC HEADING DATA
   10  REWIND 8
       NEOF=
       READ (5,11) IOP1,IOP2,IREC,NR,L,INC
   11  FORMAT (6I10)
       READ (5,12)  DRHO,LP,LIM1,LIM2,F,NFILE
   12  FORMAT (F10.0,3I10,F10.3,I10)
       READ  (5,13)     NN,TLOW,LPRO,LPTH,IRMI,IRMA,IOP3,IOP4
   13  FORMAT (I10,F10.3,4I10,2I1)
       I=0
   14  I = I+1
       READ (5,24) IFN(I),(HDG(II),II=1,7),DPHIH,DPHIV
   24  FORMAT (I2,8X,7A4,2I10)
       WRITE  (6,26)
   26  FORMAT (19H1 INPUT DATA VALUES)
       WRITE(6,9998)( HDG(IIII),IIII =1,7)
 9998  FORMAT (1H ,7A4 )
       WRITE  (6,11)  IOP1,IOP2,IREC,NR,L,INC
       WRITE  (6,12)  DRHO,LP,LIM1,LIM2,F,NFILE
       WRITE  (6,13)     NN,TLOW,LPRO,LPTH,IRMI,IRMA,IOP3,IOP4
       NN = (NN/2)*2+1
       WRITE(6,5050) NN
 5 50  FORMAT(1H0,14HCOMPUTED NN = ,I4)
 2226  IF (IREC.GE.10)  GO TO 4000
```

```
      GO TO (4000,4000,3900,3900,4000,3900,3900,3900,3900),IREC
 3900 WRITE (6,3901)  IREC
 3901 FORMAT(1H0,18HTHE VALUE OF IREC,,I2,1X,25H,IS NOT ACCEPTABLE TO AG
     A3)
      GO TO 10
 4000 DO 400 K=1,L
      RHOH1(K) = -10.0
      RHOL1(K) = -10.0
      RHOH2(K) = -10.0
  400 RHOL2(K) = -10.0
      NEOF = 0
      NEOR = 0
      NCNO = 0
      IF (I.GT.1)  GO TO 29
      DO 27 IS=1,7
      NS=IS
   27 READ  (8,28)  SYMBOL
   28 FORMAT (77X,A3)
      DATA RH4/4HRH4 /
      IF (NS.EQ.7)  BACKSPACE 8
      IF (SYMBOL.EQ.RH4)  GO TO 29
      WRITE  (6,20)  SYMBOL
   20 FORMAT  (30H INCORRECT SYMBOL IN COL.78-80,3X,A3)
   29 IF (I.EQ.1)  GO TO 40
      IF (IFN(I).EQ.IFN(I-1))  CALL ERROR(1  )
      IF (IFN(I).LT.IFN(I-1))  GO TO 30
      NSKIP = IFN(I) - IFN(I-1) - 1
      GO TO 50
   30 REWIND  8
   40 NSKIP = IFN(I) - 1
   50 CALL SKIPF(NEOF,NEOR,NSKIP)
      IRSK = IREC-1
      CALL SKIPR(IRSK)
      READ (8,60) (IHH(K),JHH(K),IVV(K),JVV(K),IVH(K),JVH(K),K=1,L)
   60 FORMAT ( 3X,6X,2I4,6X,2I4,6X,2I4)
      WRITE (6,60)  (IHH(K),JHH(K),IVV(K),JVV(K),IVH(K),JVH(K),K=1,L,LP)
      IF(DRHO .LE. 0.) GO TO 370
C
      RPD = 3.14159/180.0
      LL=  90.0 / DRHO +1.
      DRHO=DRHO*RPD
      DO 70 J = 1,LL
      ZA5 = J-1
      SINSQ(J) =  (SIN((ZA5)*DRHO))**2
      COSSQ(J) = (COS((ZA5)*DRHO))**2
      SICOS(J) = SIN((ZA5)*DRHO)*COS((ZA5)*DRHO)
   70 CONTINUE
      M = 1
      K=1
      GO TO 72
   71 K = K + INC
   72 NH =
```

```
      NL = 1
      ZA8 = JVV(K)
      TJVV = ( ZA8 + DPHIV )*RPD
      ZA9 = JHH(K)
      TJHH = ( ZA9 + DPHIH )*RPD
      COSVV = COS(TJVV)
      SINVV = SIN(TJVV)
      COSHH = COS(TJHH)
      SINHH = SIN(TJHH)
      ZA10 = IVV(K)
      SVV = 10.0**( ZA10/200.0)
      ZA11= IHH(K)
      SHH = 10.0**( ZA11/200.0)
      VVR = SVV*COSVV
      VVI = SVV*SINVV
      HHR = SHH*COSHH
      HHI = SHH*SINHH
      IF (IOP1) 110,80,110
   80 J = 1
   81 SIGR = VVR * SINSQ(J) + HHR * COSSQ(J)
      SIGI = VVI * SINSQ(J) + HHI * COSSQ(J)
      PERR = VVR * COSSQ(J) + HHR * SINSQ(J)
      PERI = VVI * COSSQ(J) + HHI * SINSQ(J)
      XR =  SIGR - PERR
      XI =  SIGI - PERI
      SUM = SQRT( XR ** 2  +  XI ** 2)
      DENOM1 = SQRT( SIGR ** 2 + SIGI** 2)
      DENOM2 = SQRT( PERR ** 2 + PERI** 2)
      RATIO(J) = SUM / (DENOM1 + DENOM2)
      IF (RATIO(J)-10.0**(-8)) 85,85,90
   85 RATIO(J) = -160.0
      GO TO 100
   90 RATIO(J) = 10.0 * ALOG10(RATIO(J))
  100 CONTINUE
      GO TO 200
  110 J=1
      ZA12= JVH(K)
  111 TJVH = ZA12*RPD
      JL1 = 0
      JL2 = 0
      JH1 = 0
      JH2 = 0
      COSVH = COS(TJVH)
      SINVH = SIN(TJVH)
      ZA13= IVH(K)
      SVH = 10.0**(ZA13/200.0)
      VHR = SVH*COSVH
      VHI = SVH*SINVH
      SIGR = VVR*SINSQ(J)+(2.0*VHR)*SICOS(J)+HHR*COSSQ(J)
      SIGI = VVI*SINSQ(J)+(2.0*VHI)*SICOS(J)+HHI*COSSQ(J)
      PERR = VVR*COSSQ(J)-(2.0*VHR)*SICOS(J)+HHR*SINSQ(J)
      PERI = VVI*COSSQ(J)-(2.0*VHI)*SICOS(J)+HHI*SINSQ(J)
```

```
      XR =  SIGR - PERR
      XI =  SIGI - PERI
      SUM = SQRT( XR ** 2 + XI ** 2)
      DENOM1 = SQRT( SIGR ** 2 + SIGI ** 2)
      DENOM2 = SQRT( PERR ** 2 + PERI ** 2)
      RATIO(J) = SUM / (DENOM1 + DENOM2)
      IF (RATIO(J)-10.0**(-8)) 115,115,117
  115 RATIO(J) = -160.0
      GO TO 200
  117 RATIO(J) = 20.0 * ALOG10(RATIO(J))
  200 CONTINUE
  201 IF (NL.NE.1)  GO TO 202
      IF (RATIO(J).GT.TLOW) GO TO 202
      NL = NL+1
      ZA14= J-1
      RHOL1(K) = ((ZA14)*DRHO)/RPD
      JL1 = J-1
  202 IF (RATIO(J).GT.TLOW)  GO TO 204
      ZA15 = J-1
      RHOL2(K) = ((ZA15)*DRHO)/RPD
      JL2 = J-1
  204 IF (J.GE.LL)  GO TO 206
      IF (IOP1.NE.0)  GO TO 205
      J = J+1
      GO TO 81
  205 J = J+1
      GO TO 111
  206 IF ((M-K).NE.0)  GO TO 208
      M = M+LPTH*INC
      WRITE  (6,207)  K,(RATIO(J),J=1,LL,LPRO)
  207 FORMAT (23H  ASPECT ANGLE NUMBER = ,I5,/(3F20.4))
      WRITE  (6,209)                                    JL1,RHOL1(K),JL2,RHOL2(K
     D)
  209 FORMAT (                                                          /
     D,7H RHOL1(,I5,3H)= ,E20.7,10X,7H RHOL2(,I5,3H)= ,E20.7)
  208 IF (K.LT. L)        GO TO 71
      DO 290  K=1,L
 2 90 WRITE (6,2091) K,RHOL1(K),K,RHOL2(K)
 2 91 FORMAT (1H0,6HRHOL1(,I4,2H)=,E20.7,5X, 6HRHOL2(,I4,2H)=,E20.7)
      NN = NN-1
      N2N = NN/2
      N2N1 = N2N + 1
      KL1 = 1 + INC
      KL2 = 1 + N2N*INC
      KL3 = L -(N2N-1)*INC
      K = 1
      RHOH2(1) = RHOL1(1)
      DO 51   KIK = 1,N2N
      JKJ16 = 1+KIK*INC
  510 RHOH2(1) = RHOH2(1) + RHOL1(JKJ16)
      ZA17 = N2N1
      RHOH1(1) = RHOH2(1) / ZA17
```

```
      JJJ = 0
      DO 52    K = KL1,KL2,INC
      JJJ = JJJ + 1
      JKJ18 = K-INC
      RHOH2(K) = RHOH2(JKJ18)
      JKJ19 = K+N2N*INC
      RHOH2(K) = RHOH2(K) + RHOL1(JKJ19)
      ZA20 = N2N1 + JJJ
  520 RHOH1(K) = RHOH2(K) / (ZA20)
      WRITE(6,5000)  KL2 , RHOH1(KL2 )
      K     = KL2
  598 K = K + INC
      JKJ21 = K-((N1N)/2)*INC
      RHOH2(K) = RHOL1(JKJ21)
  600 DO 70    KK = 1,N1N
      JKJ22 = K-((N1N)/2-KK)*INC
  700 RHOH2(K) = RHOH2(K) + RHOL1(JKJ22)
      ZA23 = NN
      RHOH1(K) = RHOH2(K) /ZA23
      IF (K.LT.L-N2N*INC) GO TO 598
      WRITE(6,5000)  K    ,RHOH1(K)
      JJJ = 0
      DO 63    K=KL3,L,INC
      JJJ = JJJ + 1
      JKJ24 = K-INC
      JKJ24A= K-N2N1*INC
      RHOH2(K) = RHOH2(JKJ24) - RHOL1(JKJ24A)
      ZA25 = NN-JJJ
  630 RHOH1(K) = RHOH2(K) / ZA25
      WRITE(6,5000)  L    , RHOH1(L    )
 5 00 FORMAT (1H0,6HRHOH1(,I4,2H)=,E20.7)
      K = 1
      RHOL1(1) = RHOL2(1)
      DO 81    KIK = 1,N2N
      JKJ26 = 1+KIK*INC
  810 RHOL1(1) = RHOL1(1) + RHOL2(JKJ26)
      ZA27 = N2N1
      RHOH2(1) = RHOL1(1) / ZA27
      JJJ = 0
      DO 82    K = KL1,KL2,INC
      JJJ = JJJ + 1
      JKJ28 = K-INC
      RHOL1(K) = RHOL1(JKJ28)
      JKJ29 = K+N2N*INC
      RHOL1(K) = RHOL1(K) + RHOL2(JKJ29)
      ZA30 = N2N1 + JJJ
  820 RHOH2(K) = RHOL1(K) / ZA30
      WRITE(6,8000)  KL2 , RHOH2(KL2 )
      K     = KL2
  898 K = K + INC
      JKJ31 = K-((N1N)/2)*INC
      RHOL1(K) = RHOL2(JKJ31)
```

```
  900 DO 1  0 KK =  ,N1N
      JKJ32 = K-((N1N)/2-KK)*INC
 1 00 RHOL1(K) = RHOL1(K) + RHOL2(JKJ32)
      ZA33 = NN
      RHOH2(K) = RHOL1(K) /ZA33
      IF (K.LT.L-N2N*INC) GO TO 898
      WRITE(6,8000)  K   ,RHOH2(K)
      JJJ = 0
      DO 93   K=KL3,L,INC
      JJJ = JJJ + 1
      JKJ34 = K-INC
      JKJ34A= K-N2N1*INC
      RHOL1(K) = RHOL1(JKJ34) - RHOL2(JKJ34A)
      ZA35 = NN-JJJ
  930 RHOH2(K) = RHOL1(K) / ZA35
      WRITE(6,8000)  L   , RHOH2(L   )
 9 01 FORMAT(1H0,I4,E20.7,E20.7)
 8 00 FORMAT (1H0,6HRHOH2(,I4,2H)=,E2 .7)
      IF (IOP3.NE.1)  GO TO 370
C **  RHOH1  IS  LOWER LIMIT OF POLARIZATION  ENVELOPE
C **  RHOH2  IS UPPER LIMIT OF POLARIZATION  ENVELOPE
  217 CALL PLTPOL(RHOH1,RHOH2 , INC , L       )
  370 IF (F.EQ.0.)  GO TO 380
C **  RATIO  IS CUMULATIVE PHASE FOR   VERTICAL  POLARIZATION
C **  RATIOH IS CUMULATIVE PHASE FOR HORIZONTAL  POLARIZATION
  375 CALL PHASE
  380 CONTINUE
      IF (I.LT.NR)    GO TO 14
  421 WRITE (6,422)
  422 FORMAT (1H ,2 HTHIS JOB IS COMPLETE.)
      STOP
      END
```

```
      SUBROUTINE PLTPOL ( RHOH1    , RHOH2    , INC , L      )
C  SUBROUTINE  PLTPOL ***  PLOTS RHOH1 AND RHOH2 VERSUS ASPECT
      DIMENSION XPAR(8) , YPAR(8) , XAR(360) , YAR(360) , ZAR(360)
      DATA XPAR / 0.0, 29.0, 2.0, 200., 17.0, 0. , 1.8, 0.1 /
      DATA YPAR / 0.0, 29.0, 5.0, 10.0, 12.0, 0. , 3.5, 0.0 /
      IF (INC.GE.10)  GO TO 215
      INCP = 10
      GO  TO  217
  215 INCP = INC
  217 CONTINUE
C ***
    1 CALL NUMBER(-180. ,1,XPAR , YPAR  )
      XPAR(7) =  6.3
      CALL NUMBER( -90. ,1,XPAR , YPAR  )
      XPAR(7) = 10.8
      CALL NUMBER(   0. ,1,XPAR , YPAR  )
      XPAR(7) = 15.3
      CALL NUMBER(  90. ,1,XPAR , YPAR  )
      XPAR(7) = 19.8
      CALL NUMBER( 180. ,1,XPAR , YPAR  )
      XPAR(7) = 1.0
      YPAR(7) = 4.0
      CALL NUMBER( -10. ,1,XPAR , YPAR  )
      YPAR(7) = 5.
      CALL NUMBER(   0. ,1,XPAR , YPAR  )
      YPAR(7) = 9.5
      CALL NUMBER(  45. ,1,XPAR , YPAR  )
      YPAR(7) = 14.
      CALL NUMBER(  90. ,1,XPAR , YPAR  )
      IBM = L - INCP
      J = 0
      DO 20 K = 1, IBM, INCP
      J = J + 1
      XAR(J) = K
      YAR(J) = RHOH1(K)
DO LOOP INDEX K MAY NOT BE REDEFINED IN CALL OR ABNORMAL FUNCTION
      ZAR(J) = RHOH2(K)
DO LOOP INDEX K MAY NOT BE REDEFINED IN CALL OR ABNORMAL FUNCTION
      II = J
   20 CONTINUE
C ***
      CALL LINE ( XAR , YAR , II , XPAR, YPAR )
      CALL LINE ( XAR , ZAR , II , XPAR, YPAR )
      CALL STDBY
      CALL STDBY
      RETURN
      END
```

```
      1            SUBROUTINE  PLTPHA (RATIO ,RATION, INC, L      )
      2            DIMENSION XPAR(8) , YPAR(8) , XAR(360) , YAR(360) , ZAR(360)
      3            DATA XPAR / 0.0, 29.0, 2.0, 20.. 17.0, 0. , 1.8, 0.1 /
      4            DATA YPAR / 0.0 , 29.0 ,15.0 , 10.0 ,12.0 , 5.0,15.0,0.0/
      5            IF (INC.GE.10)  GO TO 85
      6            INCP = 10
      7            GO  TO  90
      8         85 INCP = INC
      9         90 CONTINUE
     10       C ***
     11            1 CALL NUMBER(-180. ,1,XPAR , YPAR  )
     12              XPAR(7) =  6.3
     13              CALL NUMBER( -90. ,1,XPAR , YPAR  )
     14              XPAR(7) = 10.8
     15              CALL NUMBER(   0. ,1,XPAR , YPAR  )
     16              XPAR(7) = 15.3
     17              CALL NUMBER(  90. ,1,XPAR , YPAR  )
     18              XPAR(7) = 19.8
     19              CALL NUMBER( 180. ,1,XPAR , YPAR  )
     20              XPAR(7) = 1.0
     21              CALL NUMBER ( 0.0 , 1 ,XPAR,YPAR )
     22              YPAR(7) = 20.0
     23              CALL NUMBER (10.0 , 1 ,XPAR,YPAR )
     24              YPAR(7) = 25.0
     25              CALL NUMBER (20.0 , 1 ,XPAR,YPAR )
     26              YPAR(7) = 28.0
     27              CALL NUMBER (26.0 , 1 ,XPAR,YPAR )
     28              IBM = L - INCP
     29              J = 0
     30              DO 20 K = 1, IBM, INCP
     31              J = J + 1
     32              XAR(J) = K
     33              YAR(J) = RATIO(K)
DO LOOP INDEX K MAY NOT BE REDEFINED IN CALL OR ABNORMAL FUNCTION
     34              ZAR(J) = RATIOH(K)
DO LOOP INDEX K MAY NOT BE REDEFINED IN CALL OR ABNORMAL FUNCTION
     35              II = J
     36           20 CONTINUE
     37       C   ***
     38              CALL LINE ( XAR , YAR , II , XPAR, YPAR )
     39              CALL LINE ( XAR , ZAR , II , XPAR, YPAR )
     40              CALL STDBY
     41              CALL STDBY
     42              RETURN
     43              END
```

```
      SUBROUTINE SKIPF(NEOF,NEOR,NSKIP)
    1 IF (NSKIP.EQ.0)  GO TO 110
      NCNO = 0
      NFS = 0
      NCNO1 = NCNO
      CALL FLGEOF(8,IEOF)
   10 READ (8,15) NCNO
      IF(IEOF .EQ. 1) GO TO 40
   15 FORMAT (72X,I5,3X)
      IF (NCNO.GE.NCNO1)  GO TO 20
      NEOF = NEOF+1
      NFS = NFS + 1
   20 IF (NCNO.NE.1)  GO TO 10
      IF (NFS.LT.NSKIP)  GO TO 10
      BACKSPACE 8
   30 RETURN
   40 CALL ERROR(2  )
      GO TO 30
      ENTRY SKIPR(IRSK)
      NRS = 0
      IF (IRSK.EQ.0)  GO TO 110
      CALL FLGEOF(8,IEOF)
      IF(IEOF .EQ. 1) GO TO 100
   80 READ (8,90) DUMMY
   90 FORMAT (1X)
      NEOR = NEOR + 1
      NRS = NRS + 1
      IF (NRS.LT.IRSK )  GO TO 80
      GO TO 110
  100 CALL ERROR(  3)
  110 RETURN
      END
```

```
      SUBROUTINE ERROR(KERROR)
      GO TO (10  , 20 , 30      ),KERROR
   10 WRITE(6 , 100)
  100 FORMAT(39H  WRONG TAPE FILE CALLED * KERROR = 1   )
      GO TO 110
   20 WRITE(6 , 200)
  200 FORMAT(39H  UNEXPECTED END OF FILE * KERROR = 2   )
      GO TO 110
   30 WRITE(6 , 300)
  300 FORMAT(39H  UNEXPECTED END OF FILE * KERROR = 3   )
  110 STOP
      END
```

```
C
C       SUBROUTINE PHASE   PHASE CENTER ANALYSIS
C
        COMMON/BLOK/NEOR,NSKIP,RHOH1(4000),RHOL1(4000),RHOH2(4000),RHOL2
       1(4000),IOP1,IOP2,IREC,NR,L,INC,DRHO,LP,LIM1,LIM2,F,NFILE,K,XR,SHH,
       1 LL,RPD,KOP1,MIN,MAX,J,SVV,XI,VVR,TJVV,TJHH,COSVV,VVI,SINVV,COSHH,
       2 SINHH,HHR,HHI,SIGR,SIGI,PERR,PERI,SUM,DENOM1,DENOM2,TJVH,SVH,
       3 COSVH,SINVH,VHR,VHI,XLAMDA,IFN(20),HDG(7),IX(2),IY(2),
       4 IVV(4000),JVV(4000),IVH(4000),JVH(4000),IHH(4000),JHH(4000),
       5 SINSQ(3600),COSSQ(3600),SICOS(3600),RATIO(3600),IRMI,IRMA
       6,RATIOH(4000),LPTH,IH1(2),IL1(2),IH2(2),IL2(2),IYH(2) ,NEOF
        XLAMDA = 3.0/(10.0*F*0.0254)/720.0
        ZAH1 = JVV(1)
        RATIO(1) = ZAH1*XLAMDA
        MM=1+INC
        DO 30 I=MM,L,INC
        MPHI = 0
        JKJH2 = I-INC
        IF (JVV(I).LT.LIM2. OR.JVV(JKJH2).GT.LIM1)  GO TO 25
 9 01   MPHI =-360
        GO TO 30
   25   JKJH4 = I-INC
        IF (JVV(I).GT.LIM1. OR.JVV(JKJH4).LT.LIM2)  GO TO 30
 9 00   MPHI = 360
        JKJH6 = I-INC
        ZAH6 =(JVV(I)-JVV(JKJH6)+MPHI)
   30   RATIO(I) =RATIO(JKJH6) + ZAH6*XLAMDA
        WRITE  (6,41)
   41   FORMAT (1H0,39HOUTPUT DATA,PHASE CENTER IN INCHES (VV))
        WRITE  (6,40)  (RATIO(I),  I = 1,L,LPTH)
   40   FORMAT  (5F8.3)
        ZAH7 = JHH(1)
        RATIOH(1) = ZAH7*XLAMDA
        DO 70  I=MM,L,INC
        MPHI = 0
        JKJH8 = I-INC
        IF (JHH(I).LT.LIM2. OR.JHH(JKJH8).GT.LIM1)  GO TO  60
 9 02   MPHI =-360
        GO TO 70
   60   JKH10 = I-INC
        IF (JHH(I).GT.LIM1. OR.JHH(JKH10).LT.LIM2)  GO TO 70
 9 03   MPHI = 360
        JKJH12 = I-INC
        ZAH12 = JHH(I)-JHH(JKJH12)+MPHI
   70   RATIOH(I) = RATIOH(JKJH12) + ZAH12*XLAMDA
        WRITE   (6,79)
   79   FORMAT (1H0,39HOUTPUT DATA,PHASE CENTER IN INCHES (HH))
        WRITE  (6,80)  (RATIOH(I),  I=1,L,LPTH)
   80   FORMAT  (5F8.3)
        CALL PLTPHA( RATIO ,RATIOH ,  INC  ,  L   )
        RETURN

        END
```

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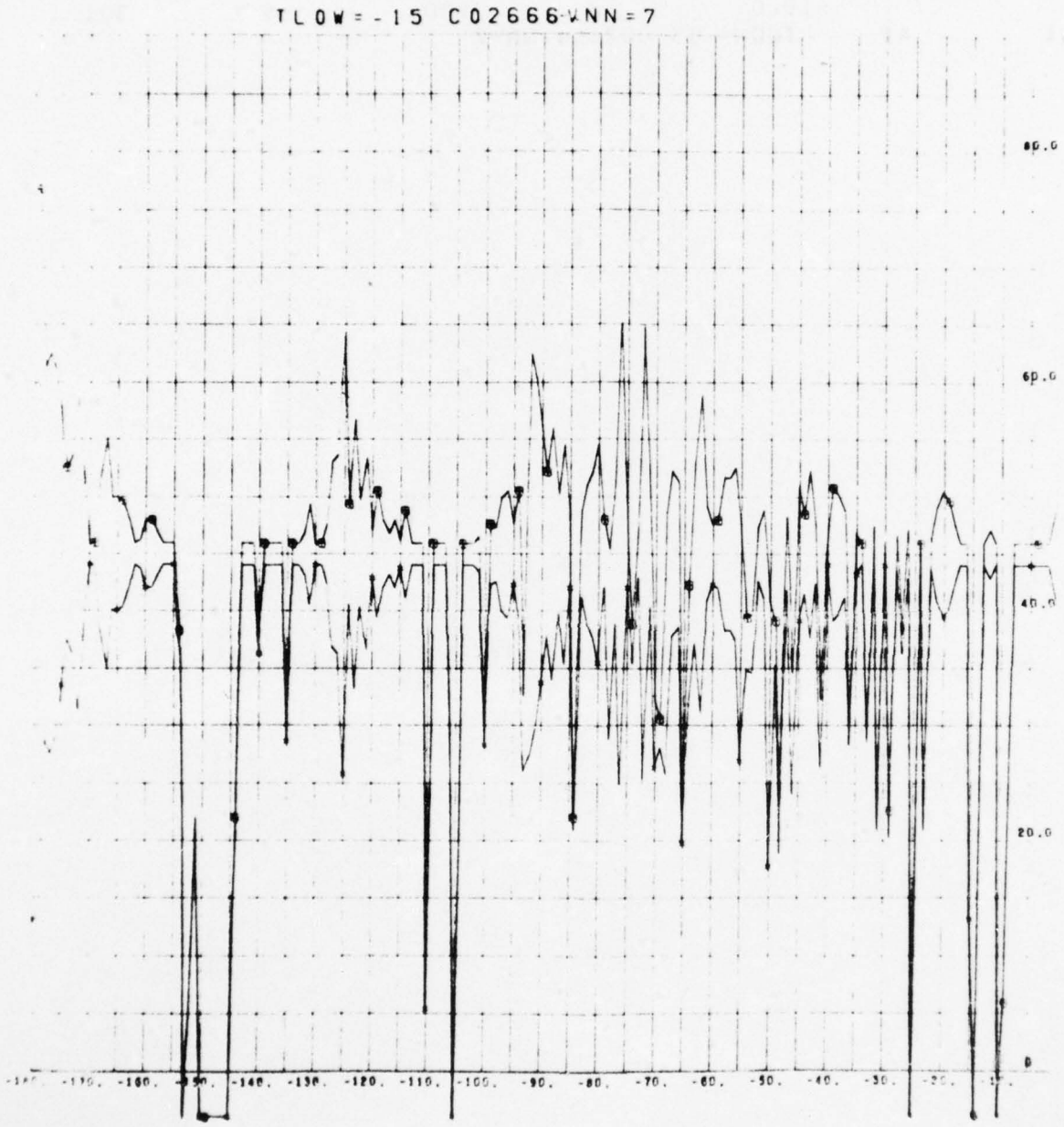
8. SAMPLE PROBLEM

8.1. Description. A sample problem is included for checking out program AG3.

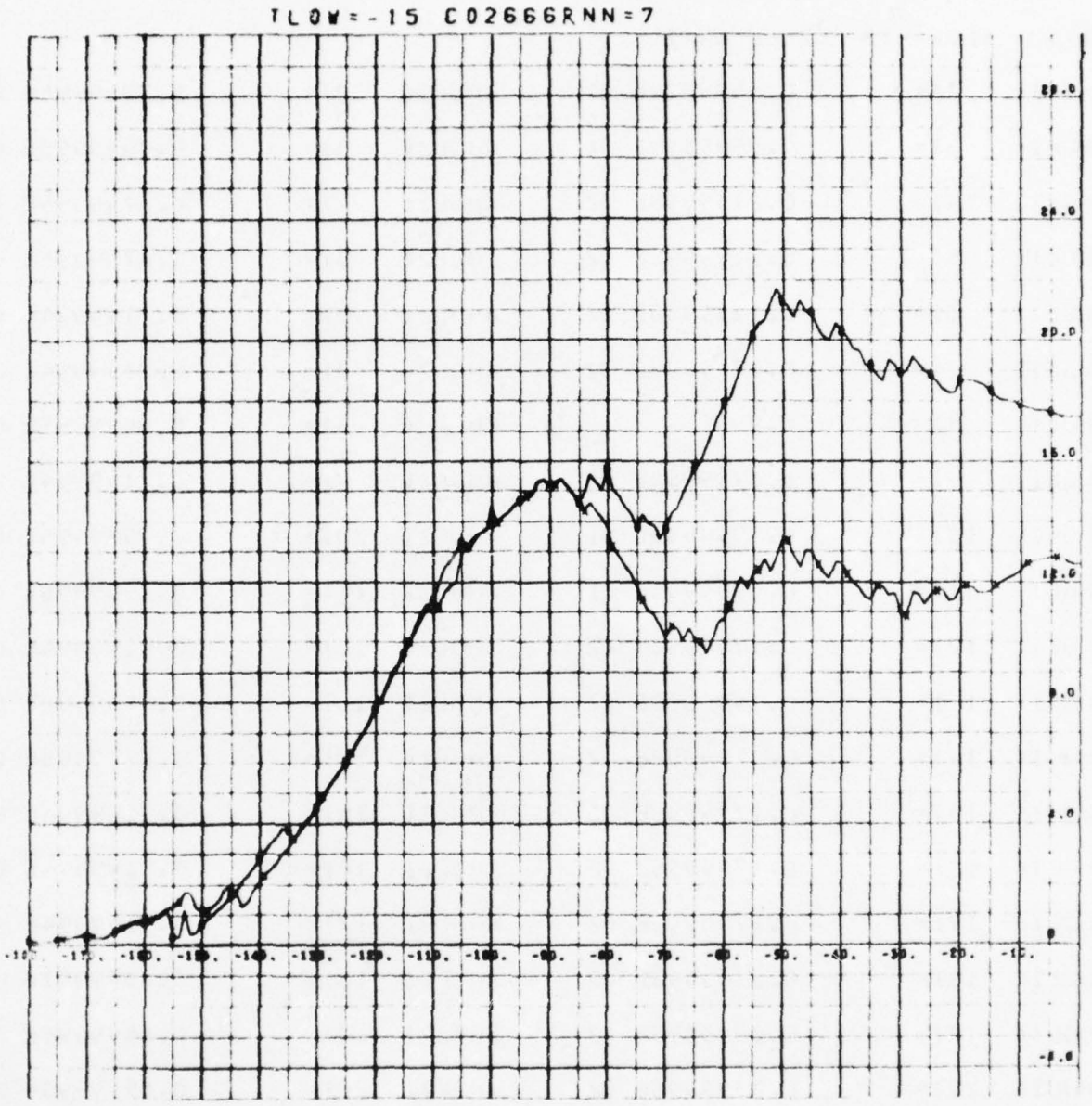
8.2. Input Data. The input data used for the sample problem is shown on the following page. The input data is explained in Section 5.1.

8.3 Output Data. A portion of the output from Procedure AG3 for the sample problem is given on the following pages.

```
         0          0          1          1       3600          1
       2.0         50         90        270        0.0          3
         7      -15.0          2       .100         -5        301
1          A1     TLOW=-15 C02666 NN=7
```



POLARIZATION SYMMETRY ENVELOPE



ABSOLUTE PHASE SIGNATURES

A1 ILOW=-15 CO2000 NN=7

RHOL1(2)=	0.9999999E 01	RHOL2(2)=	0.7999995E 02
RHOL1(3)=	0.9999999E 01	RHOL2(3)=	0.7999995E 02
RHOL1(4)=	0.2199998E 02	RHOL2(4)=	0.6799995E 02
RHOL1(5)=	0.2199998E 02	RHOL2(5)=	0.6799995E 02
RHOL1(6)=	0.1799998E 02	RHOL2(6)=	0.7199994E 02
RHOL1(7)=	0.1799998E 02	RHOL2(7)=	0.7199994E 02
RHOL1(8)=	0.0	RHOL2(8)=	0.8999997E 02
RHOL1(9)=	0.1799998E 02	RHOL2(9)=	0.7199994E 02
RHOL1(10)=	0.9999999E 01	RHOL2(10)=	0.7999995E 02
RHOL1(11)=	0.9999999E 01	RHOL2(11)=	0.7999995E 02
RHOL1(12)=	0.1799998E 02	RHOL2(12)=	0.7199994E 02
RHOL1(13)=	0.1400000E 02	RHOL2(13)=	0.7599998E 02
RHOL1(14)=	0.2199998E 02	RHOL2(14)=	0.6799995E 02
RHOL1(15)=	0.1799998E 02	RHOL2(15)=	0.7199994E 02
RHOL1(16)=	0.1799998E 02	RHOL2(16)=	0.7199994E 02
RHOL1(17)=	0.1799998E 02	RHOL2(17)=	0.7199994E 02
RHOL1(18)=	0.2399998E 02	RHOL2(18)=	0.6599997E 02
RHOL1(19)=	0.2399998E 02	RHOL2(19)=	0.6599997E 02
RHOL1(20)=	0.3399998E 02	RHOL2(20)=	0.5599998E 02
RHOL1(21)=	0.3399998E 02	RHOL2(21)=	0.5599998E 02
RHOL1(22)=	0.2999998E 02	RHOL2(22)=	0.5999994E 02
RHOL1(23)=	0.2399998E 02	RHOL2(23)=	0.6599997E 02
RHOL1(24)=	0.2999998E 02	RHOL2(24)=	0.5999994E 02
RHOL1(25)=	0.2799998E 02	RHOL2(25)=	0.6199998E 02
RHOL1(26)=	0.2599998E 02	RHOL2(26)=	0.6399998E 02
RHOL1(27)=	0.2599998E 02	RHOL2(27)=	0.6399998E 02

A1 TLOW=-15 CO2=6 NN=7

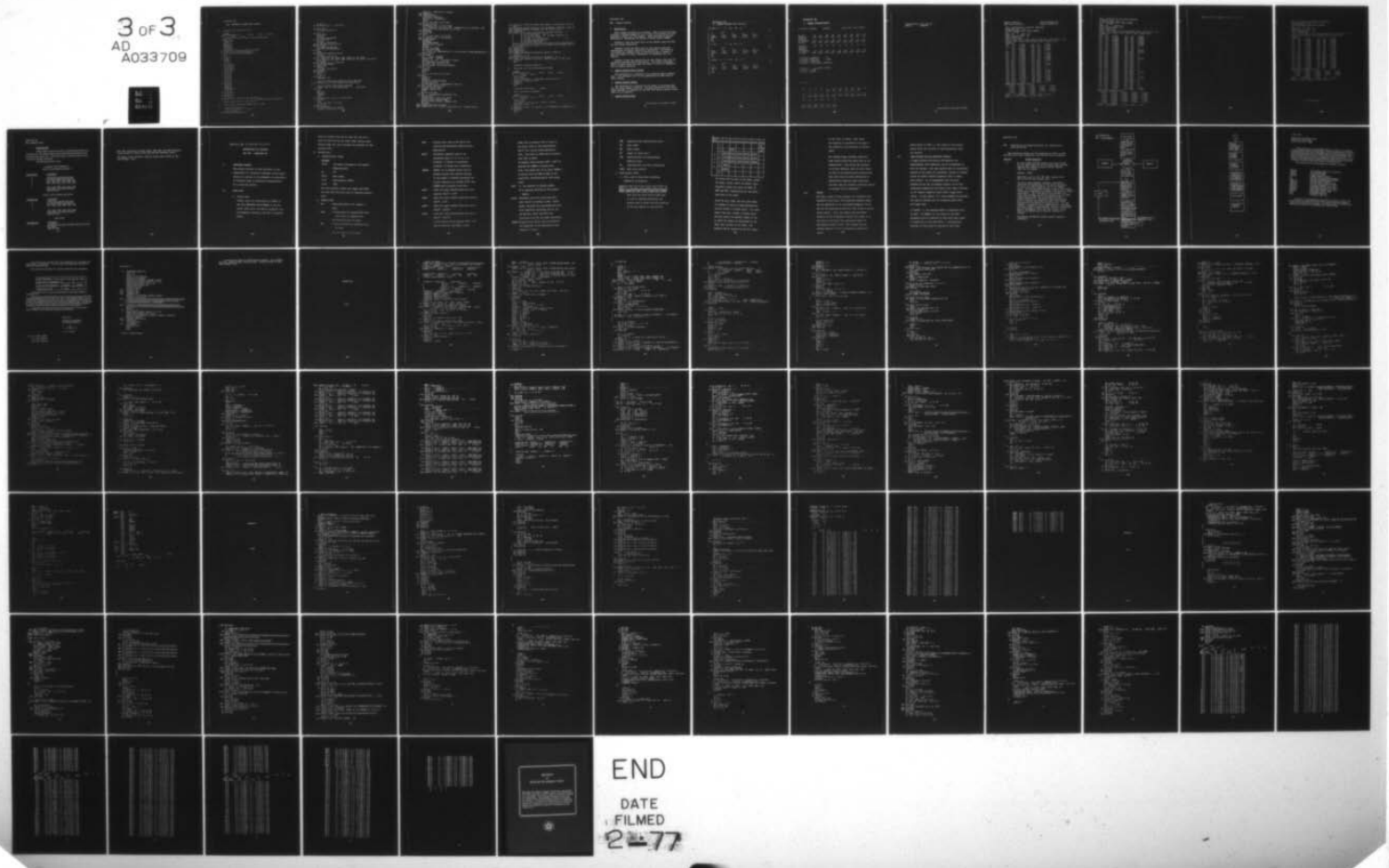
RHOL1(28)=	0.2199998E 02	RHOL2(28)=	0.6799995E 02
RHOL1(29)=	0.2599998E 02	RHOL2(29)=	0.6399998E 02
RHOL1(30)=	0.3399998E 02	RHOL2(30)=	0.5599998E 02
RHOL1(31)=	0.3399998E 02	RHOL2(31)=	0.5599998E 02
RHOL1(32)=	0.2199998E 02	RHOL2(32)=	0.6799995E 02
RHOL1(33)=	0.2599998E 02	RHOL2(33)=	0.6399998E 02
RHOL1(34)=	0.2799998E 02	RHOL2(34)=	0.6199998E 02
RHOL1(35)=	0.2999998E 02	RHOL2(35)=	0.5999994E 02
RHOL1(36)=	0.2599998E 02	RHOL2(36)=	0.6399998E 02
RHOL1(37)=	0.2599998E 02	RHOL2(37)=	0.6599997E 02
RHOL1(38)=	0.2799998E 02	RHOL2(38)=	0.6199998E 02
RHOL1(39)=	0.2799998E 02	RHOL2(39)=	0.6199998E 02
RHOL1(40)=	0.2799998E 02	RHOL2(40)=	0.6199998E 02
RHOL1(41)=	0.2999998E 02	RHOL2(41)=	0.5999994E 02
RHOL1(42)=	0.2999998E 02	RHOL2(42)=	0.5999994E 02
RHOL1(43)=	0.2999998E 02	RHOL2(43)=	0.5999994E 02
RHOL1(44)=	0.2799998E 02	RHOL2(44)=	0.6199998E 02
RHOL1(45)=	0.2999998E 02	RHOL2(45)=	0.5999994E 02
RHOL1(46)=	0.3200000E 02	RHOL2(46)=	0.5799995E 02
RHOL1(47)=	0.2999998E 02	RHOL2(47)=	0.5999994E 02
RHOL1(48)=	0.2999998E 02	RHOL2(48)=	0.5999994E 02
RHOL1(49)=	0.2999998E 02	RHOL2(49)=	0.5999994E 02
RHOL1(50)=	0.3399998E 02	RHOL2(50)=	0.5599998E 02
RHOL1(51)=	0.3599998E 02	RHOL2(51)=	0.5399998E 02
RHOL1(52)=	0.3399996E 02	RHOL2(52)=	0.5599998E 02
RHOL1(53)=	0.3399998E 02	RHOL2(53)=	0.5599998E 02

SECTION VII

SIGNATURE TYPE AMBIGUITY STUDY
COMPUTER PROGRAM DOCUMENTATION

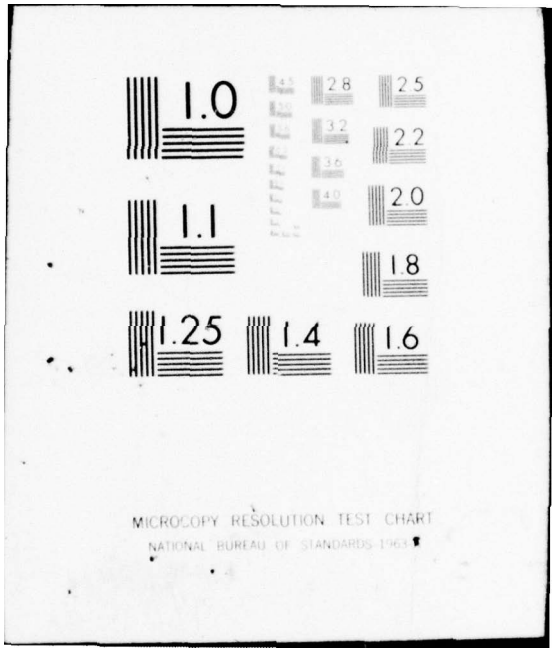
AD-A033 709 PRC INFORMATION SCIENCES CO ROME N Y F/G 15/3
SPACE SURVEILLANCE SOFTWARE SUPPORT. VOLUME III. RADAR SIGNATUR--ETC(U)
OCT 76 P R CONTI F30602-75-C-0167
UNCLASSIFIED RADC-TR-76-261-VOL-3 NL

3 OF 3
AD
A033709



END

DATE
FILMED
2-77


1.0
2.8
2.5
3.2
2.2
3.6
4.0
2.0
1.1
1.8
1.25
1.4
1.6
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963

Enclosure (B)

H65 - FORTRAN IV SOURCE DECK LISTING

```
C
C       SIGNATURE TYPE AMBIGUITY STUDY
C
        COMMON
       1/AA1/SMAT(3700,6)          M1(6),     ACUT1,     ACUT2,
       2          ACUT3,     ACUT4
        DIMENSION  AP(3700), E(3700),EE1(6),EE2(6),E1(6)
        NTA = NTA
        REWIND NTA
        NU11=-1
        ACUT1=180.
        ACUT2=0.
        ACUT3=360.
        ACUT4=181.
   20 READ(5,1005) NNN,TN,MN,SN,SAN,NS,AVGNA
   21 READ(5,1000) K,A1,A2,A3,A4,A5,J
        GO TO (30,40,50,60,70,80,90,100) ,K
   30 NC=J
        GO TO 21
   40 ISAN=J
        AVGN=A2
        NSS=J
        GO TO 21
   50 M1(2)=A1+.1
        M1(3)=A2+.1
        M1(4)=A3+.1
        M1(5)=A4+.1
        M1(6)=A5+.1
        GO TO 21
   60 E1(2)=A1
        E1(3)=A2
        E1(4)=A3
        E1(5)=A4
        E1(6)=A5
        GO TO 21
   70 ACUT1=A1
        ACUT2=A2
        ACUT3=A3
        ACUT4=A4
        ISMVAR=A5+.1
        GO TO 21
   80 IOPT=A1+.1
        GO TO 21
   90 ENORMA =A1
        GO TO 21
  100 WRITE(6,1006) NNN,TN,MN,SN,SAN,AVGNA,NS,
       1                                    E1(2),E1(3),E1(4),E1(5),E1(6) ,
       2ACUT1, ACUT2, ACUT3, ACUT4, ISMVAR
C
C       FIND CORRECT SCATTERING MATRIX DATA ON TAPE
C
        CALL FLGFCF(NTA,IEOF)
        IF (NC  .NE. NU11 )  GO TO 101
        DO 105 I=1,NUM
  105 SMAT(I,1)=ABS(SMAT(I,1))
```

```
      GO TO 180
  101 IF (NO11 .EQ. -1  ) GO TO 103

  102 READ (NTA)
      IF (IEOF) 102,102,103

  103 IEOF = 0
      READ (NTA)
      LOC=103
      IF (IEOF) 104,104,550
  104 READ (NTA) NO1
      LOC=104
      IF (IEOF) 106,106,550
  106 IF (NO .EQ. NO1) GO TO 140
  110 READ (NTA)
      IF (IEOF) 110,110,103
C     READ IN SCATTERING MATRIX
  140 I=1
      NUM=0
  141 READ (NTA) (SMAT(I,J),J=1,6)
      LOC=141
      IF (IEOF) 143,143,179
  143 IF ( SMAT(I,1) .LE. ACUT1 .AND. SMAT(I,1) .GE. ACUT2
     1.OR. SMAT(I,1) .LE. ACUT3 .AND. SMAT(I,1) .GE. ACUT4 ) GO TO 142
      GO TO 180
  142 IF (ISMVAR .LT. 1 ) GO TO 147
      DO 145 IJ=1,ISMVAR
  144 READ (NTA)
      LOC=144
      IF (IEOF) 145,145,179
  145 CONTINUE
  147 NUM=NUM + 1
      I=I+1
      GO TO 141
  179 IEOF = 0
      BACKSPACE  NTA
C
C     CHECK FOR SYNTHESIZING ADDITIVE NOISE SUBROUTINE
  180 IF(ISAN .EQ. 1 ) CALL SANSUB( NUM, AVGN ,$190)
C
C     CHECK FOR NOISE SUBTRACTION SUBROUTINE
      IF(NSS  .EQ. 2 ) CALL NSSSUB( NUM,        AVGN,$190)
  190 I1=1
      K=1
      AVGSIZ=0.
      AVGDIA=0.
      ICONT=0.
      II=1
  200 IF(SMAT(I1,1)  .GE. 0.0  ) GO TO 205
      I1=I1+1
      K=I1
      IF (K .GT. NUM)  GO TO 290
      GO TO 200
  205 DO 210 IJ=2,6
      IF (M1(IJ) .EQ. 0) GO TO 210
      EE1(IJ) = SMAT(K,IJ) - E1(IJ)
```

```
      EE2(IJ) = SMAT(K,IJ) + E1(IJ)
  210 CONTINUE
  220 ICONT=ICONT+1
      E(ICONT)= SMAT(K,1)
      SMAT(K,1) = -SMAT(K,1)
      K=K+1
      IF (K .GT. NUM ) GO TO 245
  227 DO 230 IJ=2,6
      IF(M1(IJ) .EQ. 0 ) GO TO 230
      IF ( SMAT(K,1) .LT. 0.0 .OR.  (SMAT(K,IJ) .LT. EE1(IJ)  .OR.
      SMAT(K,IJ) .GT. EE2(IJ)))  GO TO 232
  230 CONTINUE
      GO TO 220
  232 K=K+1
      IF ( K .LE. NUM ) GO TO 227
  245 IF (ICONT .EQ. 0)  GO TO 290
  250 DICONT=ICONT
      DNUM=NUM
      CCS=DICONT/DNUM
      AVGSIZ= CCS + AVGSIZ
      DAXM=0.
      DO 260 I=1,ICONT
      DO 260 IJ=1,ICONT
      IF ( DAXM .LT. AMOD(ABS(E(I) - E(IJ)),180.)) DAXM=AMOD(ABS(E(I) -
     1E(IJ)),180.)
  260 CONTINUE
      DK     =DAXM  /DNORMA
      AVGDIA= DK   + AVGDIA
      AP(II)=1./  3.0     *(CCS**2 + DK**2 )
      WRITE(6,1001) II,CCS,II,DK
      IF (IOPT .NE. 1) GO TO 270
      WRITE(6,1003) (E(IJ),IJ=1,ICONT)
  270 I1= I1+1
      II=II+1
      ICONT=0
      K=I1
      IF (I1 .LE. NUM ) GO TO 200
  290 AA=0.
      ICN=II-1
      DCN=ICN
      ENNOEC=1.-DCN/FLOAT(NUM)
      DO 300 IJ=1,ICN
      AP(IJ)=SQRT(1./3. *(ENNOEC**2) +AP(IJ))
  300 AA=1./(DCN )*AP(IJ)+AA
      AVGSIZ= AVGSIZ /DCN
      AVGDIA= AVGDIA /DCN
      DA=0.
      DO 310 IJ=1,ICN
  310 DA=     (1./DCN*(AP(IJ)-AA)**2) +DA
      DA=SQRT(DA)
      WRITE(6,1011) (AP(I),I=1,ICN)
      WRITE(6,1004) AA,DA,ENNOEC
      WRITE(6,1013) AVGSIZ , AVGDIA, NUM
      NO11=NO
 1000 FORMAT(I2,2X5E10.4,3XI4)
 1001 FORMAT(1X4H C(S  I4,2H)= F10.4,5X4H D(S  I4,2H)= F10.4 )
```

```
1002 FORMAT(31H SCATTERING MATRIX DATA NUMBER  I4,23H DOESN'T EXIST ON
    1TAPE  )
1003 FORMAT(47H AZIMUTH VALUES IN THIS EQUIVALENCE CLASS ARE  /(5F6.1))
1004 FORMAT(1X5HAVGA=F9.4,5HVARA= F10.4,8H  1-K/N=  F8.4)
1005 FORMAT(8A5)
1006 FORMAT( 1X 40H SMUS - STATISTICAL SIGNATURE AMBIGUITY    /
    1         1X 16H SIGNATURE TYPE    A5  /
    2         1X 16H SM TAPE NUMBER    A5, 14H MODEL NUMBER A5  /
    3         1X  6H S/N= A5  ,3H OB                            /
    4         1X  5H SAN=  A5 ,5X6H AVGN= A5                    /
    5         1X 20H NOISE SUBTRACTION=  A5                     /
    6         1X 18H ERROR LIMITS ARE   /
    71X6H E(1)=F6.3,6H E(2)=F6.3,6H E(3)=F6.3,6H E(4)=F6.1,6H E(5)=F6.1
    8/ 1X7H ACUT1= F6.1,7H ACUT2= F6.1,7H ACUT3= F6.1,7H ACUT4= F6.1 /
    91X 8H ISMVAR= I2  )
1008 FORMAT(I3)
1009 FORMAT(1XI4)
1010 FORMAT(6F10.3)
1011 FORMAT( 28H NORMALIZED AMBIGUITY VECTOR / (5F10.4))
     GO TO 20
 550 WRITE(6,1012) LOC
1012 FORMAT( 32H END OF FILE ERROR AT STATEMENT   I4  )
1013 FORMAT (1X, 8HAVGSIZ =,F6.4,10H  AVGDIA =,F6.4, 7H  NUM =,I4)
     GO TO 20
     END

     SUBROUTINE SANSUB(NUM,AVGN ,*)
C
C    SUBROUTINE FOR SYNTHESIZING ADDITIVE NOISE
C
     COMMON
    1/AA1/SMAT(3700,6)          M1(6),    ACUT1,    ACUT2,
    2         ACUT3,    ACUT4
     DO 50 I=1,NUM
     DO 50 J=2,4
     EIJ= 10.*ALOG10(1. + 10.**((AVGN -SMAT(I,J))/10. ) )
     SMAT(I,J) = SMAT(I,J) +EIJ
  50 CONTINUE
     RETURN 1
     END

     SUBROUTINE NSSSUB(NUM,      AVGN,*)
C
C    NOISE SUBTRACTION SUBROUTINE
C
     COMMON
    1/AA1/SMAT(3700,6)          M1(6),    ACUT1,    ACUT2,
    2         ACUT3,    ACUT4
     DO 50 I=1,NUM
     DO 50 J=2,4
     IF (SMAT(I,J) - AVGN  .GT.  0.0433 ) GO TO 40
     SMAT(I,J) = AVGN - 20.0
     GO TO 50
  40 SMAT(I,J) = AVGN + 10.* ALOG10 ( 10. **((SMAT(I,J) -AVGN)*.1)-1.)
  50 CONTINUE
     RETURN 1
     END
```

Enclosure (C)

H65 - Sample Problem

1. Description

Three sample problems are included. Each of these problems utilizes a reduced signature set in order to minimize the time required to check out the program. This time may be further shortened by increasing the values of ACUT2 and/or ISMVAR.

Problem 1 uses the first file on the library tape and does not use either subroutine.

Problem 2 uses the first file on the library tape and incorporates the Noise Subtraction Subroutine. The value of -15.0 dBsm for average noise is artificial and is chosen so that the effect of noise subtraction on ambiguity will be obvious.

Problem 3 uses the second file on the library tape and the Synthesize Additive Noise Subroutine. The value of average noise is again chosen so that the effect of noise on ambiguity will be easily detected.

2. Sample Problem Deck Listing

The following is a listing of the enclosed sample problem deck. See Enclosure (E) for an explanation of each term of this listing.

3. Sample Problem Output

The following is a listing of the output of procedure H65 for the three sample problems. The time required to run these three problems in sequence on the IBM 7090 using a binary source deck is 0.72 minutes.

4. Sample Problem Deck

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Enclosure (C)
2. Sample Problem Deck Listing

```
 SM 64D11  3    72   NO   NO  -65
1                                                                    1
2                -65.                                                0
3  1.            1.          1.          1.          1.
4  1.01          1.01        1.01        10.01       10.01
5  180.0         160.0       160.0       160.0       2.0
6  0.
7  20.
8
 SM 64D11  3    72   NO  YES  -15
1                                                                    1
2                -15.                                                2
3  1.            1.          1.          1.          1.
4  1.01          1.01        1.01        10.01       10.01
5  180.0         160.0       160.0       160.0       2.0
6  0.
7  20.
8
 SM 64D11  3    52  YES   NO  -15
1                                                                    2
2                -15.                                                1
3  1.            1.          1.          1.          1.
4  1.01          1.01        1.01        10.01       10.01
5  180.0         160.0       160.0       160.0       2.0
6  0.
7  20.
8
```

Enclosure (C)

3. Sample Problem Output

```
9 175529 0 0627200       GRUVER G          04117 0825  H65  250079


90 UNIT          RD    PU    PR    A1    A2    A3    A4    A5    A6
FUNCTION        CRD   PCH   PRT   LB1   IN1   OU1   PP1   CK1   LB2
SYMBOLIC
40 LOGICAL       32    33    34    00    01    02    03    04    05
40 UNIT        DISK  DISK  DISK  DISK  DISK  DISK  DISK  DISK  DISK

90 UNIT          B8    B9    B0    C1    C2    C3    C4    C5    C6
FUNCTION
SYMBOLIC
40 LOGICAL       17    18    19    20    21    22    23    24    25
40 UNIT        DISK  DISK  DISK  DISK  DISK  DISK  DISK  DISK  DISK


9 175529 0 $SETUP 09        09
9 175529 0 $EXECUTE         IBJOB
9 175552 0 EXECUTION
9 175611 0  THIS JOB IS COMPLETE.


9 175611 0     142 LINES OUTPUT.
9 175611 0 $IBSYS
9 175611 0 $STOP



0627 79  00


   A7    A8    A9    A0    B1    B2    B3    B4    B5    B6    B7
                           UT1   UT2   UT3   UT4   CK2   LB4
    9
   06    07    08    09    10    11    12    13    14    15    16
   C1  DISK  DISK  DISK  DISK  DISK  DISK  DISK  DISK  DISK  DISK

   01    02    03    04    05    06


   26    27    28    29    30    31
 DISK  DISK  DISK  DISK  DISK  DISK
```

```
!BJOB VERSION 5 HAS CONTROL.
$!BJOB              NOSOURCE
```

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```
GENERAL DYNAMICS                          7090 PROCEDURE H65
FORT WORTH DIVISION                       PROBLEM 062079-001

 SMUS - STATISTICAL SIGNATURE AMBIGUITY
 SIGNATURE TYPE    SM
 SM TAPE NUMBER 64D11 MODEL NUMBER    3
 S/N=    72  DB
 SAN=  NO         AVGN= -65
 NOISE SUBTRACTION=    NO
 ERROR LIMITS ARE
 E(1)= 1.010 E(2)= 1.010 E(3)= 1.010 E(4)=  10.0 E(5)=  10.0
 ACUT1= 180.0 ACUT2= 160.0 ACUT3= 160.0 ACUT4= 160.0
 ISMVAR= 2
 C(S    1)=     0.0741        D(S    1)=     0.0650
 C(S    2)=     0.0741        D(S    2)=     0.0650
 C(S    3)=     0.0741        D(S    3)=     0.0550
 C(S    4)=     0.0926        D(S    4)=     0.0850
 C(S    5)=     0.0185        D(S    5)=     0.
 C(S    6)=     0.0741        D(S    6)=     0.0550
 C(S    7)=     0.0556        D(S    7)=     0.0300
 C(S    8)=     0.0556        D(S    8)=     0.0450
 C(S    9)=     0.0370        D(S    9)=     0.0150
 C(S   10)=     0.0370        D(S   10)=     0.0200
 C(S   11)=     0.0185        D(S   11)=     0.
 C(S   12)=     0.0370        D(S   12)=     0.0150
 C(S   13)=     0.0370        D(S   13)=     0.0200
 C(S   14)=     0.0185        D(S   14)=     0.
 C(S   15)=     0.0185        D(S   15)=     0.
 C(S   16)=     0.0370        D(S   16)=     0.0150
 C(S   17)=     0.0370        D(S   17)=     0.0200
 C(S   18)=     0.0370        D(S   18)=     0.0150
 C(S   19)=     0.0370        D(S   19)=     0.0150
 C(S   20)=     0.0370        D(S   20)=     0.0150
 C(S   21)=     0.0370        D(S   21)=     0.0200
 C(S   22)=     0.0370        D(S   22)=     0.0150
 C(S   23)=     0.0185        D(S   23)=     0.
NORMALIZED AMBIGUITY VECTOR
   0.3363    0.3363    0.3357    0.3393    0.3316
   0.3357    0.3334    0.3340    0.3322    0.3323
   0.3316    0.3322    0.3323    0.3316    0.3316
   0.3322    0.3323    0.3322    0.3322    0.3322
   0.3323    0.3322    0.3316
AVGA=   0.3332VARA=    0.0020  1-K/N=  0.5741
AVGSIZ =0.0435  AVGDIA =0.0254  NUM =  54
```

```
SMUS - STATISTICAL SIGNATURE AMBIGUITY
SIGNATURE TYPE    SM
SM TAPE NUMBER 64D11 MODEL NUMBER    3
S/N=    72  DB
SAN=  NO        AVGN= -15
NOISE SUBTRACTION=  YES
ERROR LIMITS ARE
E(1)= 1.010 E(2)= 1.010 E(3)= 1.010 E(4)=  10.0 E(5)=  10.0
ACUT1= 180.0 ACUT2= 160.0 ACUT3= 160.0 ACUT4= 160.0
ISMVAR= 2
C(S    1)=     0.0741        D(S    1)=     0.0650
C(S    2)=     0.0741        D(S    2)=     0.0650
C(S    3)=     0.0926        D(S    3)=     0.0750
C(S    4)=     0.0556        D(S    4)=     0.0400
C(S    5)=     0.0370        D(S    5)=     0.0200
C(S    6)=     0.0556        D(S    6)=     0.0300
C(S    7)=     0.0185        D(S    7)=     0.
C(S    8)=     0.0185        D(S    8)=     0.
C(S    9)=     0.0370        D(S    9)=     0.0150
C(S   10)=     0.0370        D(S   10)=     0.0150
C(S   11)=     0.0185        D(S   11)=     0.
C(S   12)=     0.0185        D(S   12)=     0.
C(S   13)=     0.0185        D(S   13)=     0.
C(S   14)=     0.0370        D(S   14)=     0.0200
C(S   15)=     0.0185        D(S   15)=     0.
C(S   16)=     0.0185        D(S   16)=     0.
C(S   17)=     0.0185        D(S   17)=     0.
C(S   18)=     0.0185        D(S   18)=     0.
C(S   19)=     0.0185        D(S   19)=     0.
C(S   20)=     0.0185        D(S   20)=     0.
C(S   21)=     0.0185        D(S   21)=     0.
C(S   22)=     0.0370        D(S   22)=     0.0150
C(S   23)=     0.0185        D(S   23)=     0.
C(S   24)=     0.0185        D(S   24)=     0.
C(S   25)=     0.0370        D(S   25)=     0.0150
C(S   26)=     0.0185        D(S   26)=     0.
C(S   27)=     0.0185        D(S   27)=     0.
C(S   28)=     0.0185        D(S   28)=     0.
C(S   29)=     0.0185        D(S   29)=     0.
C(S   30)=     0.0185        D(S   30)=     0.
C(S   31)=     0.0370        D(S   31)=     0.0200
C(S   32)=     0.0370        D(S   32)=     0.0200
NORMALIZED AMBIGUITY VECTOR
   0.2420     0.2420     0.2451     0.2385     0.2365
   0.2380     0.2355     0.2355     0.2363     0.2363
   0.2355     0.2355     0.2355     0.2365     0.2355
   0.2355     0.2355     0.2355     0.2355     0.2355
   0.2355     0.2363     0.2355     0.2355     0.2363
   0.2355     0.2355     0.2355     0.2355     0.2355
   0.2365     0.2365
AVGA=    0.2366VARA=    0.0022  1-K/N=  0.4074
```

AVGSIZ =0.0312 AVGDIA =0.0130 NUM = 54

```
SMUS - STATISTICAL SIGNATURE AMBIGUITY
SIGNATURE TYPE    SM
SM TAPE NUMBER 64011 MODEL NUMBER    3
S/N=    52  DB
SAN= YES        AVGN= -15
NOISE SUBTRACTION=    NO
ERROR LIMITS ARE
E(1)= 1.010 E(2)= 1.010 E(3)= 1.010 E(4)=  10.0 E(5)=  10.0
ACUT1= 180.0 ACUT2= 160.0 ACUT3= 160.0 ACUT4= 160.0
ISMVAR= 2
C(S    1)=     0.0556        D(S    1)=     0.0400
C(S    2)=     0.0556        D(S    2)=     0.0550
C(S    3)=     0.0741        D(S    3)=     0.0750
C(S    4)=     0.0926        D(S    4)=     0.0700
C(S    5)=     0.0556        D(S    5)=     0.0450
C(S    6)=     0.0556        D(S    6)=     0.0450
C(S    7)=     0.0556        D(S    7)=     0.0300
C(S    8)=     0.0741        D(S    8)=     0.0550
C(S    9)=     0.0741        D(S    9)=     0.0550
C(S   10)=     0.0556        D(S   10)=     0.0300
C(S   11)=     0.0370        D(S   11)=     0.0150
C(S   12)=     0.0556        D(S   12)=     0.0400
C(S   13)=     0.0370        D(S   13)=     0.0250
C(S   14)=     0.0370        D(S   14)=     0.0200
C(S   15)=     0.0556        D(S   15)=     0.0350
C(S   16)=     0.0556        D(S   16)=     0.0350
C(S   17)=     0.0370        D(S   17)=     0.0200
C(S   18)=     0.0370        D(S   18)=     0.0200
NORMALIZED AMBIGUITY VECTOR
   0.3869    0.3875    0.3897    0.3907    0.3871
   0.3871    0.3866    0.3886    0.3886    0.3866
   0.3854    0.3869    0.3858    0.3857    0.3868
   0.3868    0.3857    0.3857
AVGA=    0.3871VARA=    0.0014  1-K/N=  0.6667
AVGSIZ =0.0556  AVGDIA =0.0394  NUM =  54
```

142 LINES OUTPUT.

Enclosure (D)

H65 LIBRARY DATA

1. DESCRIPTION

Library data for procedure H65 are described in Section II of enclosure (4). The library tapes for procedure H65 are produced from raw data by procedure H31. The library tape is written in binary mode, 7-track at a density of 800 BPI.

The following format is used:

LIBRARY TAPE FORMATS

FILE 1 (SCATTERING MATRIX 1)

RECORD NO.	CONTENTS
1	STANDARD HEADER RECORD
2	NO (SCATTERING MATRIX ID)
3	SM1, SM2, SM3, SM5, SM4, SM6
4	SM1, SM2, SM3, SM5, SM4, SM6
.	.
.	.
.	.
	SM1, SM2, SM3, SM5, SM4, SM6
	STANDARD TRAILER RECORD
	END OF FILE

FILE K (SCATTERING MATRIX K)

RECORD NO.	CONTENTS
1	STANDARD HEADER RECORD
2	NO (SCATTERING MATRIX ID)
3	SM1, SM2, SM3, SM5, SM4, SM6
4	.
.	.
.	.
	SM1, SM2, SM3, SM5, SM4, SM6
	STANDARD TRAILER RECORD
	END OF FILE

LAST FILE

RECORD NO.	CONTENTS
1	STANDARD TRAILER RECORD FOR LAST FILE ON TAPE.
	END OF FILE

Here SM1 represents azimuth angle, SM2, SM3, and SM5 represent cross section in dbsm, while SM4 and SM6 represent phase.

The phase terms represent relative phase where SM4=$\phi_{12} - \phi_{11}$ and SM6=$\phi_{22} - \phi_{11}$.

Enclosure (E) H65-Customer Utilization

INSTRUCTIONS TO CUSTOMER

IBM 7090 PROCEDURE H65

I. PROCEDURE PURPOSE

The primary function of this procedure is the computation of a normalized ambiguity vector which serves as a measure of the ambiguity or uncertainty of different types of signature representations of a scattering vehicle.

II. INPUT DATA

A. Library Data

Library tapes are identified by a label of the form XXXXXXDNN where XXXXXX is the job number under which the tape is produced, D is an alphabetic character, and NN is a sequence number.

Only one library tape may be input per job and it must be listed on the job sheet under Library Input. Library tapes for this procedure are produced by 7090 procedure H31.

B. Problem Data

1. Identification Format

Columns

63-68 Job number (assigned by the Digital Computing Lab).

69 "P"

70-72 Deck number

73-77 Card sequence number

78-80 "H65"

The card sequence number must begin with 00001 for each deck and cards must be numbered sequentially.

2. Symbols Used

NO Scattering matrix I.D. number on tape.

ISAN =1 Subroutine for synthesizing additive noise on signature set

=0 Subroutine won't be used.

NSS =2 Noise subtraction subroutine will be used.

=0 Subroutine won't be used.

AVGN	Average noise used in the Noise Subtraction and Synthesize Additive Noise Subroutines.
M1(J)	Determines signature type to be considered where J = 2, 3, 4, 5, 6. If M1(J) = 1 Column is considered If M1(J) = 0 Column isn't considered
ISMVAR	ISMVAR = N, N azimuth values will be skipped between each azimuth reading. If the number of azimuth recordings for a given signature set exceeds 2250, then ISMVAR must be greater than zero.
ACUT1	Value for upper azimuth bound for first interval 180.0° - 0.0°.
ACUT2	Value for lower azimuth bound for interval 180.0° - 0.0°.
ACUT3	Value for upper azimuth bound for interval 360.0° - 180.0°.
ACUT4	Value for lower azimuth bound for interval 360.0° - 180.0°. If the azimuth values between 360° - 180° are not desired, set ACUT2 = ACUT4.

ACUT1 must be greater than or equal to the first value on tape approximately 180.0° for a given scattering matrix file. The value of ACUT4 must be greater than that of ACUT1.

If azimuth values between 360° - 180° are desired and ISMVAR is greater than zero, then ACUT4 must be at least ISMVAR = N records from the END OF FILE on the particular scattering matrix file being used.

IOPT =1 for printout of azimuth angles.
=0 to suppress printing of the azimuth angles.

E1(J) Determines the error associated with each azimuth recording on tape. E1(2), E1(3), and E1(4) are associated with the three amplitude recordings for VV, VH, and HH data, E1(5) and E1(6) are associated with the two phase recordings.

DNORMA Normalization factor used to normalize the magnitude of the equivalence class diameter to unity.

NNN	Signature type identification data
TN	Tape number
MN	Model number
SN	Signal to noise ratio
SAN	Identification for synthesizing additive noise
NS	Identification for noise subtraction
AVGN	Mean cross section

3. Card Formats (H65)

a. First card of each deck containing alphameric information.

Card Cols.	1-5	6-10	11-15	16-20	21-25	26-30	31-35
Data	NNN	TN	MN	SN	SAN	NS	AVGN

Data from the first card of each deck is used as heading information and nowhere does it enter into the selection of desired options or calculations.

b.

Card Cols	1-2	5-14	15-24	25-34	35-44	45-54	60-61
DATA	1						NO
	2		AVGN				ISAN NSS
	3	M1(2)	M1(3)	M1(4)	M1(5)	M1(6)	
	4	E1(2)	E1(3)	E1(4)	E1(5)	E1(6)	
	5	ACUT1	ACUT2	ACUT3	ACUT4	ISMVAR	
	6	IOPT					
	7	DNORMA					
	8						

All items will be zero if not input, except for ACUT1, ACUT2, ACUT3, and ACUT4, these variables assume the values of 180^{o}, 0^{o}, 360^{o} and 181^{o}, respectively for the first card deck if not input.

Items NO, NSS, ISAN, and data type number in columns 1-2 must be right-adjusted and written without a decimal point. All other input items must contain a decimal point and may contain an exponent (power of ten by which the number is multiplied) in the right most columns of its field. The exponent may be omitted if the last column

of the field is blank. When input, the exponent is preceded by its sign or the character E and contains no decimal point.

For optimum usage, problems using the same stored scattering matrix may be run sequentially. This allows the customer to utilize different sets of error limits as well as the existing noise subroutines. Note that once the noise subtraction or synthesizing additive noise subroutine has been used the original scattering matrix in storage will be destroyed.

III. OUTPUT

The basic output of this program is a listing of the normalized size C(SI), the normalized diameter D(SI), and the magnitude of the normalized ambiguity vector for the Ith equivalencd class for each of the K equivalence classes. Also, the sample mean and sample variance of the K ambiguity vectors are output as is the value of one minus the normalized number of equivalence classes 1-K/N. The average size and average diameter of the K equivalence classes are output.

Additionally if IOPT = 1, the values of the azimuth angles which are included in each equivalence class are printed.

IV. TIME ESTIMATE FOR H65-AMBIGUITY PROGRAM

A single problem utilizing an SM signature and approximately 1500 signatures can be accomplished in four (4) minutes. The time required may be considerably reduced as the number of equivalence classes is reduced either by using a simpler signature type or larger error limits. It is recommended that the first problems of any set of problems consist of the most complicated signatures and lowest error limits followed by the simpler signature types and/or larger error limits. In this manner, if a time estimate is exceeded, the shorter problems will be truncated rather than the longer ones.

If ISMVAR = 1, the maximum number of signatures will be 1800. If ISMVAR = 0, the values of the ACUT parameters must be adjusted to limit the total number of signatures to less than 2250. A corresponding increase in time would be required in this case.

Enclosure (F)

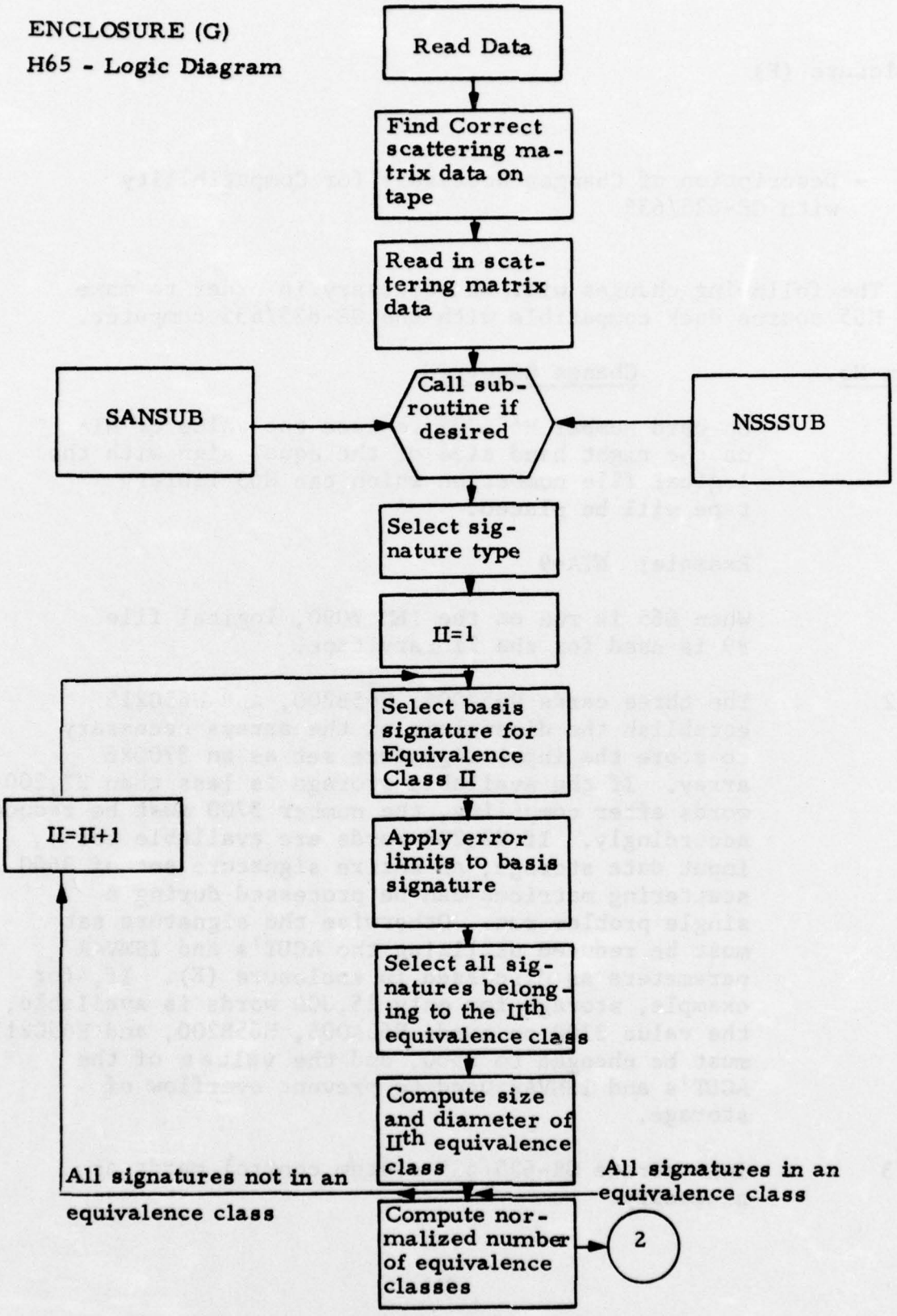
H65 - Description of Changes Necessary for Compatibility with GE-625/635

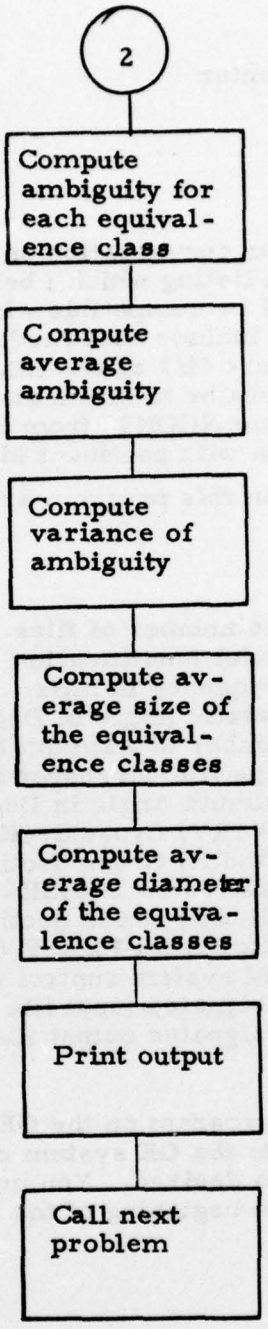
The following changes will be necessary in order to make the H65 source deck compatible with the GE-625/635 computer.

Item No.	Change Required
1	On card number H65A009 replace the value of NTA on the right hand side of the equal sign with the logical file number on which the H65 library tape will be placed. Example: NTA=9 When H65 is run on the IBM 7090, logical file #9 is used for the library tape.
2	The three cards H65A006, H65B200, and H65C215 establish the dimensions of the arrays necessary to store the input signature set as an 3700X6 array. If the available storage is less than 22,200 words after compiling, the number 3700 must be reduced accordingly. If 22,200 words are available for input data storage, an entire signature set of 3600 scattering matrices can be processed during a single problem run. Otherwise the signature set must be reduced utilizing the ACUT's and ISMVAR parameters as discussed in enclosure (E). If, for example, storage for only 15,000 words is available, the value 3700 on cards H65A006, H65B200, and H65C215 must be changed to 2500, and the values of the ACUT's and ISMVAR used to prevent overflow of storage.
3	Incorporate GE-625/635 system control cards as necessary.

ENCLOSURE (G)

H65 - Logic Diagram




2
Compute ambiguity for each equivalence class
Compute average ambiguity
Compute variance of ambiguity
Compute average size of the equivalence classes
Compute average diameter of the equivalence classes
Print output
Call next problem

6 July 1967

Rome Air Development Center
Griffiss Air Force Base
Rome, New York 13440

With reference to our conversation on July 5, 1967, I an enclosing a simple computer program listing which I believe will enable you to generate a magnetic tape which will be compatible with the GE635 computer. The input to this program will include both cards and the standard SMUS library tapes produced by Procedure H31 on the IBM computer at GD/FW. The purpose of this program will be to eliminate the IBM system control words (represented by the variable NCONT) from the library tape and to provide a listing of the library data with pertinent identification data.

The variables used in this program are identified as follows:

NFILES	The number of files to be reproduced
NMOD	Model Identification
NFREQ	Frequency in MHz
ANGLE	Bistatic Angle in Degrees
N	Number of Azimuth Measurements
NO	Tape file corresponding to NMOD
SMAT(1)	Azimuth Angle in Degrees
SMAT(2)	(TV,RV) Cross Section in dBsm
SMAT(3)	(TV,RH) Cross Section in dBsm
SMAT(4)	Differential PHASE ($\Psi_{VH} - \Psi_{VV}$)
SMAT(5)	(TH,RH) Cross Section in dBsm
SMAT(6)	Differential PHASE ($\Psi_{HH} - \Psi_{VV}$)
NCONT	IBM system control word
NTA	Designates input file
NTB	Designates output file

In order to run this program on the GE635 computer, it should only be necessary to incorporate the GE system control cards and designate values for NTA and NTB as desired. You might also like to include a tape identification number at the beginning of the output listing.

Note, that I have used input file 5 and output file 6 for card input and listed output, respectively. You may desire to change these numbers to conform to the GE system.

The table below indicates the required format for the card inputs.

Card Columns	1 - 6	7 - 12	13 - 18
Input Card #1	NFILES=3		
Input Card #2	NMOD=3	NFREQ	ANGLE
Input Card #3	N	3000	0

Items NFILE and N must be right-adjusted and written without a decimal point.

This program should facilitate the direct conversion from all the IBM formatted tapes produced by Procedure H31. The simplest manner of providing these data appear to be for us to send you the pertinent H31 tapes so that you can duplicate them and then return the originals to us. Any attempt to remove the effects of the control words directly in the SMUS computer programs would necessitate extensive changes in each program.

I hope this approach meets with your approval and is successful. Please contact me if additional information is desired.

Sincerely,

GENERAL DYNAMICS
Fort Worth Division

G. W. Gruver

G. W. Gruver

P.S. $N_1 = 2853$ [180°]
$N_2 = 2836$ [180°]
$N_3 = 2732$ [180.4]

Enclosure (1)

```
  10    DIMENSION SMAT (6)
        NTA = 09
        NTB = 10
        READ (5,1000) NFILES
        DO 200 K=1, NFILES
        READ (5,1001) NMOD, NFREQ, ANGLE
        READ (NTA) NCONT, (SMAT (J), J=1,6)
        WRITE (NTB) (SMAT (J), J=1,6)
        READ (NTA) NCONT, NO
        WRITE (NTB) NO
        READ (5,1000) N
1000    FORMAT (I2)
1001    FORMAT (3A6)
1005    FORMAT (I4)
        WRITE (6,1010) NMOD, NFREQ, ANGLE
        WRITE (6,1015) N, NO
1010    FORMAT (1X37HSCATTERINGbMATRIXbDATAbIDENTIFICATION//
       11X13HMODELbNUMBERbA6,12HFREQUENCYb-bA6,3HMHZ,
       217HBISTATICbANGLEb=bA6,7HDEGREES)
1020    FORMAT (1X39HNUMBERbOFbAZIMUTHbMEASUREMENTSb
       1EQUALSbbI4,1X33HFORbSCATTERINGbMATRIXbDATAbFILEbbI4)
        M=N+1
  50    DO 100 I=1,M
        READ (NTA) NCONT, (SMAT (J), J=1,6)
        WRITE (NTB) (SMAT (J), J=1,6)
        WRITE (6,1030) SMAT(1), SMAT(2), SMAT(3), SMAT(5),
       1SMAT(4), SMAT(6)
1030    FORMAT (6(5X, F6.1))
 100    CONTINUE
        END FILE NTB
 200    CONTINUE
        END FILE NTB
        STOP
        END
```

NOTE: b indicates blank

In developing the SPECT and DISCRM computer programs , three programs were used. These are SPECT, CLASS and TRAIN. Fortran listings for these three programs follow.

SECTION VIII

SPECT

```
C         SPECT AND SPECT3                5
      COMMON/BLOCK1/CKSAT(361), CKITH(4,361),LAST,IVARRF,THOLD,IRO,DRANG
     1, IRS , IA , IRSTRT , ICTRL , VSTD , ITH, CONST , SAT , IMODE ,
     2  SIGCAL , CKONE(361) , ANOISE
      COMMON/BLOCK2/  NS(361)         ,ISB(361,10)     ,ISNCT(361,10)  ,
     1INTST(361,1 )  ,ISPCT(361,1 )  ,ISE(361,10)     ,SIG(540)
C
C
      COMMON/BLOCK4/  INPN(36 ,3 )    ,R(361,30)       ,S(361,30)      ,
     1INPN(36 )       ,IINPN(    3 )  ,RR(    30)      ,SS(    30)
      COMMON /INPUT7 INDAT(360),IEOF
C
C
      DIMENSION    THDES(361) ,      IDATA(540) ,
     1                    IFSKP(2 )  ,        HEADR(5)  ,     TRAILR(5)  ,
     2                    NSUB(4)    ,
     3                    THETS(4,9) ,        THETE(4,9) ,    SIGREF(4)
     4,                  SYSATT(4) ,  THMISS(30) ,
     5                    NVDITH(5),      VOIDL(5),      VOIDH(5)
      DIMENSION     CCKSAT(36 ),    CCKONE(361)
      DIMENSION  IPOS(361),VSTDP(361) , IRSP(361)
      DIMENSION ITHETA(2) ,IIA(2)
      DIMENSION  HEAD(5),TRAIL(8)
      DIMENSION  TGTID(12), POLID(3)
      DIMENSION  BASE(4), REFMIS(30), XAR(2), YAR(2)
    5 CONTINUE
      READ  (5,1 0  TGTID , IUN , FREQ , NPOL , NBRTGT
 1000 FORMAT( 12A4, 3X, I2, F5. , 4X,I1, 1X, I2 )
      WRITE (6,2 6 ) TGTID, IUN, FREQ, NPOL, NBRTGT
 2060 FORMAT ( 9H TARGET =,12A4,//9H IUN    =,I3,/9H FREQ   =,F6.2,
     1        /9H NPOL   =, I3 . /9H NBRTGT =,I4 )
      IF ( NPOL .GT.    .AND.  NPOL .LE. 3 )  GO TO 6
      WRITE (6,1 02)
 1002 FORMAT (15H NPOL INCORRECT )
      CALL EXIT
    6 CONTINUE
      READ (5,1 '0)  DRANG, TGTDIM, THINC, VSTD
 1040 FORMAT( 6F'0.  )
      WRITE(6,2 70)  DRANG, TGTDIM, THINC, VSTD
 2070 FORMAT ( 9H DRANG  =,F7.3, /9H TGTDIM =,F6.2,/9H THINC  =,F6.2,
     1        /9H VSTD   =,F6.2  )
      IF (THINC .GT.  .  .AND. THINC .LE. 2.0)  GO TO 11
      WRITE (6,1 38)
 1038 FORMAT (22H THINC IS NOT CORRECT )
      CALL EXIT
   11 CONTINUE
      IF ( DRANG .GT. 0.4 .AND.  DRANG .LT. 0.7 )  GO TO 7
      WRITE (6,1 03)
 1003 FORMAT (16H DRANG INCORRECT )
      CALL EXIT
    7 CONTINUE
      THTEST = 1 .*THINC
```

```
      DTH = 1.5*THING
      READ (5,1 2 ) NFILES, NFSKP, NRPS, ICNTER,INOISE,IBIAS1, IRS
     1,              IIRS1 , IIRS2
 1020 FORMAT( 12I5 )
      WRITE (6,2 8 ) NFILES, NFSKP, NRPS, ICNTER,INOISE, IRS ,IBIAS1
     1 ,             IIRS1 , IIRS2
 2080 FORMAT ( 9H NFILES =,I4  , /9H NFSKP  =,I3,/9H NRPS   =, I3 ,
     1        /9H ICNTER =,I5  , /9H INOISE =,I6,/9H IRS    =, I4 ,
     2        /9H IBIAS1 =,I5  , /9H IIRS1  = ,I5,/9H IIRS2  = ,I5 )
      NUMSAM = (TGTDIM + 30. ) /(2.0*DRANG)
      IRO = ICNTER - (IRS + NUMSAM)
      LAST = ICNTER + NUMSAM
      IF (NFILES .GT. 0  .AND.  NFILES .LT. 30)  GO TO 8
      WRITE (6,1 04)
 1004 FORMAT ( 18H NFILES INCORRECT )
      CALL EXIT
    8 CONTINUE
      IF ( INOISE .GT. 800 .AND. INOISE .LT. 2000 )  GO TO 9
      WRITE (6,1 05)
 1005 FORMAT (23H NOISE LEVEL INCORRECT )
      CALL EXIT
    9 CONTINUE
      IUN = 8
      NWDS = 9 *NRPS
      CONST1  = FLOAT(INOISE)
      CONST =   CONST1       * 1  00.0
      ANOISE = 1 0.* CONST + .1
      BASE(1) = (CONST1 + FLOAT(IBIAS1))/100.0
      BASE(2) = (CONST1 + 2  . ) / 100.0
      BASE(3) = BASE(2)
      BASE(4) = BASE(2)
      THOLD = BASE(1)
      BIAS  = BASE(2)
      LAST1 = LAST + 12
      IIRRS = IRS
      THOLDA = THOLD
      WRITE (6,2 19) THOLD
 2019 FORMAT ( 9H THOLD = , F8.2)
      IF( LAST .LT. ( 9  + IRO ) ) LAST = NWDS*0.9
      IF( NRPS .GT.    .AND.
     1    NRPS .LE. 6        ) GO TO 10
      WRITE (6,2 2 )
 2020 FORMAT ( 16H NRPS INCORRECT )
      CALL EXIT
C
   10 CONTINUE
      IF( NFSKP .EQ.    ) GO TO 14
       READ  (5,1021)( IFSKP(J),J=1,NFSKP )
       WRITE (6,2031 )( IFSKP(J),J=1,NFSKP )
 2030 FORMAT (25H FILES TO BE SKIPPED ARE ,/1H ,10(2X,I5) )
      GO TO 15
   14 IFSKP(1) =
```

```
   15 CONTINUE
C
C
      JMISS =
      IFILE = 1
      ISKP  = 1
      ID = NBRTGT*1  0  + 1
      IIRS  = 1
      KMISS =
      WRITE (5,8810) TGTID ,FREQ ,NPOL ,NBRTGT ,ID
      WRITE(43,8810) TGTID ,FREQ ,NPOL ,NBRTGT ,ID
 8810 FORMAT( 12A4,F7.2,I5,I6,              7H      F   ,I6)
C*****   *****   *****   *****
      DO 700 IP=1,NPOL
C
      READ (5,1030) POLID, NVOID
 1030 FORMAT ( 3A4,2X,I4)
      IF (NVOID .LT. 5)       GO TO 16
      CALL EXIT
   16 IF (NVOID .EQ. 0)       GO TO 19
      READ (5,1035) ( VOIDL(I),VOIDH(I), I = 1,NVOID)
 1035 FORMAT ( 10F6.  )
   19 CONTINUE
      READ (5,1040) NATPOL,IDLPOS
 1040 FORMAT ( 5X,I ,2X,I3 )
      IABPOS =IABS(IDLPOS)
      IF( NATPOL .GT.    ) GO TO 20
      WRITE (6,2040)
 2040 FORMAT (38H NO. OF ATTENUATIONS/POLARIZATION = 0 )
      CALL EXIT
C
   20 READ (5,1050) (SYSATT(J),NSUB(J),SIGREF(J)    , J=1,NATPOL)
 1050 FORMAT ( 5(F5. ,4X,I1,F5. ) )
C
C
      DO 25 J=1,NATPOL
      IF( NSUB(J) .GT. 0 ) GO TO 25
      WRITE (6,2045)
 2045 FORMAT (16H NSUB INCORRECT )
      CALL EXIT
   25 CONTINUE
C
      DO 30 I=1,NATPOL
      L = NSUB(I)
      READ  (5,1010)( THETS(I,J), THETE(I,J), J=1,L )
   30 CONTINUE
      WRITE (6,2050) POLID
 2050 FORMAT (25H INPUT DATA PERTINENT TO ,3A4,14H POLARIZATION )
      WRITE (6,2051) NATPOL
 2051 FORMAT (25H NUMBER OF ATTENUATIONS =, I5 )
      WRITE (6,2052) (SYSATT(J),NSUB(J),SIGREF(J)    , J=1,NATPOL)
 2052 FORMAT (4 H    SYSTEM     NUMBER  OF   REFERENCE      ,
```

```
     1/        4 H ATTENUATION  SUBINTERVALS  X SECTION      ,
     2/      (1X,F5.1,10X,I1,1X,F6.2)
     3)
      WRITE (6,2053)
 2053 FORMAT (36H CONTROL DATA FOR ASPECT MERGING...   ,
     1/        4 H ATTENUATION  INTERVAL    START    STOP   ,
     2/        4 H    LEVEL                 ANGLE    ANGLE    )
      DO 4   I=1,NATPOL
      L = NSUB(I)
      DO 4   J=1,L
      IF( J .GT. 1 ) GO TO 35
      WRITE (6,2054) I,J,THETS(I,J),THETE(I,J)
 2054 FORMAT( 6X,I1,10X,I1,7X,F6.1,4X,F6.1 )
      GO TO 4
   35 WRITE (6,2055)   J,THETS(I,J),THETE(I,J)
 2055 FORMAT(        17X,I1,7X,F6.1,4X,F6.1 )
   40 CONTINUE
C
      TINY = THETS(1,1)
      BIG  = THETE(1,NSUB(1))
      IF( NATPOL .EQ. 1 ) GO TO 33
      DO 32 IA=2,NATPOL
      IF( THETS(IA,1) .LT. TINY )       TINY = THETS(IA,1)
   32 IF( THETE(IA,NSUB(IA)) .GT. BIG ) BIG  = THETE(IA,NSUB(IA))
   33 CONTINUE
C
      J = 1
      THDES(1) = TINY
  200 J = J + 1
      THDES(J) = THDES(J-1) + THINC
      IF ( THDES(J) .LT. BIG)  GO TO 200
      NDTH = J
C
      DO 205  J=1,NDTH
      DO 205  IA=1,NATPOL
  205 CKITH(IA,J) =  .
      DO 21   J=1,NDTH
      CKSAT(J) =  .
      CKONE(J) =  .
      IPOS(J) = IRS
      NS(J) = 1
  210 NFN(J)  =
      DO 211  JK = 1,NDTH
      VSTEP(JK) = 0.
      IBSP (JK) =
  211 CONTINUE
      JTHSP =
      IF( THDES(1) .EQ. THETS(1,1) ) GO TO 203
      J =
  201 J = J + 1
      IF( THDES(J) .EQ. THETS(1,1) ) GO TO 202
      CKITH(1,J) = 1.
```

```
      CKONE(J) = 1.
      CKSAT(J) =-1.
      GO TO 2 1
  202 JTHSRT = J - 1
  203 CONTINUE
      IF( THDES(NDTH) .EQ. THETE(1,NSUB(1)) ) GO TO 2 7
      J =
  204 J = J + 1
      IF( THDES(J) .LT. THETE(1,NSUB(1)) ) GO TO 204
  206 J = J + 1
      CKITH(1,J) = 1.
      CKSAT(J) = -1.
      CKONE(J) =  1.
      IF( J .LT. NDTH ) GO TO 2 6
  207 CONTINUE
      NUMVD =
      IF( NVOID .EQ. 0 ) GO TO 121
      DO 1  I= ,NVOID
  100 NUMVD = FLOAT(NUMVD) + (VOIDH(I)-VOIDL(I))/THINC - .6
  121 NASP = NDTH - NUMVD
      IF( NSUB(1) .EQ. 1 ) GO TO 240
C
      L = 0
      NSUB1 = NSUB(1)
      DO 23   J = 2, NSUB1
      TEST = THETE(1,J-1)
  215 L = L + 1
      IF( ABS( TEST - THDES(L) ) .GT. 0.1 ) GO TO 215
      JJ1 = L + 1
      TEST = THETS(1, J )
  220 L = L + 1
      IF( ABS( TEST - THDES(L) ) .GT. 0.1 ) GO TO 220
      JJ2 = L - 1
C
      DO 225 II=JJ1,JJ2
      CKITH(1,II) = 1.
      CKONE(II) = 1.
  225 CKSAT( II ) =-1.
  230 CONTINUE
C
  240 CONTINUE
      DO 243 II = 1,NDTH
      CCKONE(II) = CKONE(II)
      CCKSAT(II) = CKSAT(II)
  243 CONTINUE
      IA   = 1
      ICTRL = 1
      IOFT = 1
      IMISS =
      INT = 1
      NN   =
      ITH = JTHSRT
```

```
      IF( THDES(  1   ) .GT. 34 .AND.
     1    IA .EQ. 1  .AND. INT .EQ. 1 ) GO TO 241
      GO TO 242
  241 WRITE (6,1900)
 1900 FORMAT (80H A STARTING ANGLE GREATER THAN 340 DEGREES FOR IA=1 AND
     1INT=1 CANNOT BE ACCOMODATED      )
      CALL EXIT
  242 CONTINUE
      CALL FLGERR ( IUN, IERR )
      IERR =
  245 THFIN = THETE(IA,INT)
      ISPTST =
      SIGNUM = SIGREF(IA) + SYSATT(IA)
C
  250 IF( IFILE .NE. IFSKP(ISKP) ) GO TO 270
      WRITE (6,6006)
 6006 FORMAT (17H FILE TEST START )
  251 CONTINUE
C
      CALL DATAIN
      IF (IEOF) 255,252,255
  252 IF (IERR)  26 ,251,26
C
  260 WRITE (6,7001) IFILE
 7001 FORMAT (20H I/O ERROR BYPASSING FILE ,I5)
      IERR =
      GO TO 251
C
  255 WRITE (6,7000) IFILE
      IEOF =
 7000 FORMAT (15H BYPASSED FILE , I5 )
  265 IFILE = IFILE + 1
      IF( ISKP .GE. NFSKP ) GO TO 270
      ISKP = ISKP + 1
      GO TO 25
C
  270 CONTINUE
      WRITE (6,6007)
 6007 FORMAT (30H FILE TEST END - FILE PROCESS BEGIN )
C
      IPASS = 1
      IOER =
      IGN =
  275 ITH = ITH + 1
C
  278 ISRT = 1
      IHD =3
  280 CONTINUE
  292 ISTP = ISPT + 89
      IF( ISRT .EQ. 91 ) IHD = 1
      IF( ISRT .EQ. 181) IHD = 2
C
```

```
C
      GO TO (28',281,290),IHD
  281 CONTINUE
      CALL DATAIN
      DECODE(INDAT(1),4000)(HEADR(J),J=1,5)
 4000 FORMAT(5A4)
      JK = 1
      DO  199 J = ISRT,ISTP,3
      DECODE(INDAT(JK),401 ) IDATA(J)
 4010 FORMAT(17X,I5)
      JK = JK+3
      DECODE(INDAT(JK),4020) IDATA(J+1)
 4020 FORMAT(19X,I5)
      JK = JK + 4
      DECODE(INDAT(JK),4030) IDATA(J+2)
 4030 FORMAT(15X,I5)
  199 JK = JK +3
      DECODE(INDAT(304),4040) IIA(IHD),(TRAILR(J),J=1,5),ITHETA(IHD)
 4040 FORMAT(5X,I3,5A4,A1,I7,2X)
      IF (IEOF) 310,282,31
  282 IF (IERR)  315,3 0,315
  290 CONTINUE
      CALL DATAIN
      DECODE(INDAT(1),4000) (HEAD(J),J=1,5)
      JK = 1
      DO 4050  J = ISRT,ISTP,3
      DECODE(INDAT(JK),401 ) IDATA(J)
      JK = JK +3
      DECODE(INDAT(JK),4020)  IDATA(J+1)
      JK = JK +4
      DECODE(INDAT(JK),4030)  IDATA(J+2)
 4050 JK = JK +3
      DECODE(INDAT(304),4060)(TRAIL(J),J=1,8)
 4060 FORMAT(4X,8A4)
      IF (IEOF) 310,291,31
  291 IF (IERR)  315,3 0,315
C
  300 IF( ISTP .GE. NWDS ) GO TO 320
      ISRT = ISRT + 90
      IHD = 3
      GO TO 28
C
C
   70 CONTINUE
   74 CONTINUE
C
C
  310 WRITE (6,702) IFILE
      IEOF =
 7002 FORMAT (3 H OFILL ASSUMED AT END OF FILE (,I2,45H)...REPLACE DATA
     'STARTING WITH RESTART ANGLE  )
      IF ( ( THIN - THDES(ITH) ) .LE. THINC ) GO TO 96
```

```
      IOFT = 2
      IFILE = IFILE + 1
      GO TO 278
   96 WRITE ( 6,534  ) IFILE
 5340 FORMAT ( 6H FILE , I3 ,21H IS ASSUMED COMPLETE )
      GO TO 411
C
C
  315 CONTINUE
      GO TO (151,152,152) , IHD
  151 ITHETA(IHD) = ITHETA(IHD) + THTEST
  152 WRITE (6,7003) IFILE , ITHETA(1)
 7003 FORMAT (32H ERROR ATTEMPTING TO READ FILE ( ,I2,12H ), ASPECT = ,
     1        I6   )
      IERR = 0
      CALL EXIT
C
C
  320 CONTINUE
      IGN =
      ABSITH = ITHETA(1) - ITHETA(2)
      IF ( ABS(ABSITH) .GT. THTEST )  GO TO 120
  119 THETA = FLOAT(ITHETA( )) /10.0
      GO TO 13
  120 IF( ITH .EQ.  ) GO TO 119
      T1 = FLOAT(ITHETA(1))/10.
      T2 = FLOAT(ITHETA(2))/10.
      D1 = ABS( THETA - T1 )
      D2 = ABS( THETA - T2 )
      IF( D1 .LT. D2 ) GO TO 125
      THETA = T2
      GO TO 13
  125 THETA = T
  130 CONTINUE
C
      ISPTST = ISPTST + 1
      IF ( ISPTST .NE. 2 )   GO TO 319
      IF ( SYSATT(IA) .EQ. FLOAT(IIA(1))/10.0   .OR.
     1     SYSATT(IA) .EQ. FLOAT(IIA(2))/10.0 )  GO TO 319
      WRITE (6,6015)  SYSATT(IA), IFILE
 6015 FORMAT (5 H***** ATTENUATION LEVEL OF TAPE WAS NOT EQUAL TO ,
     1  F8.2, 18H        FILE NO. = , I5 )
      CALL EXIT
  319 CONTINUE
      IF( IA .GT. 1 .OR. IP .GT. 1 .OR. INT .GT. 1 )GO TO 317
      IF ( ISPTST .GT. 1 )                 GO TO 317
      IMODE = 1
      IF ( IDATA(9 ) .LT.    )  IMODE = 2
      IF (IMODE .EQ. 1)      VSTD = FUNC(VSTD,CONST)
      IF ( IMODE .EQ. 2 )    GO TO 285
      SAT = 99.98
      IF ( THOLD .LT.  7.0  .OR.  THOLD .GT. 30.0 )  GO TO 284
```

```
      GO TO 317
  284 WRITE (6,61  ) THOLD
 6100 FORMAT (47H *** TAPE IN VOLTAGE .... THRESHOLD IMPROPER = , F7.2 )
      CALL EXIT
  285 SAT = -  .2
      IF ( THOLD .GT. -15.  .OR.  THOLD .LT. -25.0)  GO TO 286
      GO TO 317
  286 WRITE (6,615 ) THOLD
 6150 FORMAT (42H *** TAPE IN DB .... THRESHOLD IMPROPER = , F7.2)
      CALL EXIT
  317 CONTINUE
      GO TO (324,321),IOFT
  321 IOFT = 1
      IF ( SYSATT(IA) .EQ. FLOAT(IIA(1))/10.0  .OR.
     1     SYSATT(IA) .EQ. FLOAT(IIA(2))/10.0  )     GO TO 90
      WRITE (6,6015)  SYSATT(IA), IFILE
      CALL EXIT
   90 CONTINUE
      ITH = ITH - 1
      TEST = THETA
      J =
  322 J = J + 1
      IF( ABS( THDES(J) - ABS(THETA) ) .GT. DTH ) GO TO 322
      NN = NN - (ITH-J) - 1
C
      IF (J .LE. ITH)   GO TO 326
      IF ( (J-ITH) .LT. 2)  GO TO 328
      L1 = ITH + 1
      L2 = J - 1
      DO 327 L = L1,L2
      CKONE( L ) = 1.0
  327 CONTINUE
      GO TO 328
  326 CONTINUE
      DO 323 L = J,ITH
      NPN(L) =
      CKSAT(L) = CCKSAT(L)
      CKONE(L) = CCKONE(L)
  323 CONTINUE
  328 CONTINUE
C
C
      ITH=
      GO TO 34
C
  324 GO TO (325,33 ),IPASS
  325 IF( THETA .GT. 340. ) THETA = THETA - 360.
      IF( THETA .GE. 0. ) GO TO 330
      IF( ABS(THETA) .GE. THINC ) GO TO 278
  330 IF( ABS(THDES(ITH) - ABS(THETA) ) .LE. DTH    ) GO TO 34
      IF ( THETA .LT. THDES(ITH) )  GO TO 335
      WRITE (6,70  ) THDES(ITH)
```

```
 7010 FORMAT (14H ASPECT ANGLE ,F6.1, 9H MISSING )
      IMISS = IMISS + 1
      JMISS = JMISS + 1
      THMISS(JMISS) = THDES(ITH)
      IF( IMISS .LT. 5 ) GO TO 331
      WRITE (6,7011)
 7011 FORMAT (32H TOO MANY ASPECT ANGLES MISSING    )
      CALL EXIT
  331 CONTINUE
      IF( THDES(ITH) .GE. THFIN ) GO TO 400
      ITH = ITH + 1
      GO TO 33
C
  335 IF ( IPASS .EQ. 2 )            GO TO 278
      GO TO 35
  340 IPASS = 2
      CKITH(IA,ITH) = 1.
      NN = NN + 1
C
      WRITE (6,7020) NN,ITH,(HEADR(J),J=1,5),IIA(1),(TRAILR(J),J=1,4),
                                                  TRAILR(5), ITHETA(1)
 7020 FORMAT ( 7H SWEEP(,I3, 9H), THDES(,I3,3H)  ,5A4,3X,I3,4A4,A1,I7)
  350 CONTINUE
      IMISS =
      GO TO (278,355),IPASS
C
  355 IF( IA .EQ. 1 ) GO TO 365
      IF( CKSAT(ITH) ) 365,356,370
  356 L = IA -
      ISUM = 0
      DO 36  JJ=1,L
  360 ISUM = FLOAT(ISUM) + CKITH(JJ,ITH) + 0.6
      IF( ISUM .EQ. L ) GO TO 365
      CKSAT(ITH) = -1.
      CKONE(ITH) =  1.
C
  365 CONTINUE
      DO 366  IJ = 1,LAST1
  366 SIG(IJ) = FLOAT(IDATA(IJ))/100.0
C
C
  374 CONTINUE
      CALL  SUBIRS ( SIG , IRSS , VSTDD , IIRS1, IIRS2 )
      IF ( VSTDD .GT. BIAS )      GO TO 372
  373 CONTINUE
      CALL SUBIRS ( SIG, IRS3, VSTDD, IIRS0, IIRS1 )
      IF (VSTDD .GT. BIAS)        GO TO 382
      GO TO 383
  372 IF (MODE .EQ. 1)      VSTDD = FUNC(VSTDD,CONST)
      IF (NN .EQ. 1)        GO TO 381
      IF ((VSTD-VSTDD) .GT. 3.)    GO TO 373
      GO TO 381
```

```
  382 IF (IMODE .EQ. 1)   VSTDD = FUNC(VSTDD,CONST)
      IF (NN .EQ. 1)  GO TO 383
      IF ((VSTD-VSTDD) .GT. 3. )   GO TO 383
  381 CONTINUE
      VSTD = VSTDD
      IRS  = IRSS
      GO TO 384
  383 CONTINUE
      KMISS = KMISS + 1
      RFFMIS(KMISS) = THDES(ITH)
  384 CONTINUE
C
      VSTDP(ITH) = VSTD
      IRSP (ITH) = IRS
      IVARRF =
      SIGCAL = SIGNUM - VSTD
      IF (IA .EQ. 1)   GO TO 367
      IDLTST =IABS(IPOS(ITH)-IRS) - IABPOS
      IF (IDLTST .LE. IABPOS)   GO TO 369
      IRSTRT = IRS + IRO - IDLPOS
      IVARRF = IDLPOS
      GO TO 368
  369 IRSTRT = 2*IRS + IRO - IPOS(ITH)
      IVARRF = IRS - IPOS(ITH)
      GO TO 368
  367 CONTINUE
      IPOS(ITH) = IRS
      IRSTRT = IRS + IRO
      IF (ITH.GT. 1)  GO TO 368
      IF (IMODE .EQ. 1)  THOLDA= FUNC(THOLD,CONST)
      THDBSN = THOLDA+ SIGCAL
  368 WRITE (6,900 ) VSTD, IRS, CKSAT(ITH), CKITH(IA,ITH), CKONE(ITH)
 9000 FORMAT (7H VSTD =,F7.2,26H DB      POSITION OF REF. =,I3,5X,7HCKSAT
     1 =,F5.1,5X,7HCKITH =,F5.1,5X,7HCKONE =,F5.1 )
      IRS = IRS - IVARRF
      RRWRT =(IRSTRT  -IRS)*DRANG
      WRITE (6,900 1) IRSTRT, RRWRT, (SIG(J),J=IRSTRT,LAST)
 9001 FORMAT (27H RECORD DATA FROM IRSTRT = , I3,
     1/  3H  = ,F6. ,26H IN. REFERENCED TO DIPOLE , / , (20F6.2) )
      WRITE (6,900 2) ICTRL
 9002 FORMAT (36H ***** SPECT3 ENTRY *****    ICTRL = , I2 )
      CALL        SPECT3
      IRS = IRS + IVARRF
      IF (CKONE(ITH) .EQ. 1.0)  CKONE(ITH) = 0.0
      WRITE (6,900 8)  NPN(ITH), NS(ITH)
 9008 FORMAT (36H ***** SPECT3 EXIT *****  NPN = , I2,5X,11HNSATT NOW =,
     A I2 )
      IF (NPN(ITH) .EQ. 0)  GO TO 371
      JJ1 = NPN(ITH)
      WRITE (6,901 )(INPN(ITH,KK),R(ITH,KK),S(ITH,KK),KK=1,JJ1 )
 9010 FORMAT('X,5(I ,F6.1,F5.1,1X)/(1X,5(I ,F6.1,F5.1,1X) ) )
  371 CONTINUE
```

```
      IF( NS(ITH) .LT. 1 ) CKSAT(ITH) = 1.
C
  370 CONTINUE
      IF( THDES(ITH) .LT. THFIN ) GO TO 275
C
C
  400 CONTINUE
      WRITE (6,3000)
 3000 FORMAT (18H FILE PROCESS END )
C
      IF ( IFILE .EQ. NFILES )    GO TO 465
  410 CONTINUE
      CALL DATAIN
      IF (IEOF)  411,414,411
  414 IF (IERR)  412,410,412
  412 WRITE (6,7005) IFILE
 7005 FORMAT (34H I/O ERROR READING TO EOF IN FILE , I5 )
      IERR = 0
      GO TO 410
C
  411 CONTINUE
      WRITE (6,7004) IFILE
 7004 FORMAT (18H COMPLETED FILE(,I2,1H) )
      WRITE (6,3002)
 3002 FORMAT (31H END OF FILE - FILE TEST START )
      IFILE = IFILE + 1
  420 IF( IFILE .NE. IFSKP(ISKP) ) GO TO 450
  421 CONTINUE
      CALL DATAIN
      IF (IEOF)  425,422,425
  422 IF (IERR)  43 ,421,43
C
  430 WRITE (6,7001) IFILE
      GO TO 421
C
  425 WRITE (6,7000) IFILE
C
  435 IFILE = IFILE + 1
      IF( ISKP .GE. NFSKP ) GO TO 450
      ISKP = ISKP + 1
      GO TO 42
  450 CONTINUE
      WRITE (6,3004)
 3004 FORMAT (18H FILE TEST END )
C
      IF( INT .GE. NSUB(IA) ) GO TO 455
      INT = INT + 1
      GO TO 46
C
  455 CONTINUE
      WRITE (6,3100)  ( VSTDP(JK), IRSP(JK), JK = 1, NASP )
 3100 FORMAT (11H VSTD  IRS , 9(11H  VSTD  IRS),//,(10(F6.1,I5)) )
```

```
      DO 554  JK = 1,NASP
      VSTDP(JK) = 0.
      IRSP (JK) = 0
  554 CONTINUE
C
      IF (IA .GE. NATPOL)   GO TO 465
      INT = 1
      IA  = IA + 1
      NN  = 0
      ICTRL = 2
      J =
      TEST = THETS(IA,1)
      THOLD = BASE(IA)
      DO 459  KKLL = 1,NDTH
      CCKSAT(KKLL) = CKSAT(KKLL)
      CCKONE(KKLL) = CKONE(KKLL)
  459 CONTINUE
      WRITE (6,5010) THOLD
 5010 FORMAT ( 8H THOLD = ,F6.2 )
      GO TO 461
  460 TEST = THETS(IA,INT)
      J = ITH
  461 J = J + 1
      IF( ABS( TEST - THDES(J) ) .GT. 0.1 ) GO TO 461
      ITH = J - 1
      GO TO 245
C
  465 CONTINUE
      IF (IFILE .NE. NFILES)  GO TO 467
      WRITE (6,3100)  ( VSTDP(JK), IRSP(JK), JK = 1, NASP )
  467 CONTINUE
      THOLD = BASE(1)
      WRITE (6,3006)
 3006 FORMAT (13H END OF FILE )
C
      IF (JMISS .EQ. 0)       GO TO 464
      WRITE(6,7600 )  (THMISS(J), J=1,JMISS)
 7600 FORMAT (///31H **********************************
     1        /31H **********************************
     2/41H THE FOLLOWING ASPECT ANGLES WERE MISSING //, (F10.1),
     3       //31H **********************************
     4         31H **********************************   // )
  464 CONTINUE
      IF (ID    .NE. 1)   GO TO 466
      ID = ID + 1
      WRITE (6,8811)  LAST,THDBSM,IRO,THINC,DRANG,IIRRS, ID
      WRITE(43,8811)  LAST,THDBSM,IRO,THINC,DRANG,IIRRS, ID
 8811 FORMAT (I6,F11.1,I10,F11.1,F10.2,I6,14X,7H      P ,I6)
C
  466 ID = ID + 1
      WRITE (6,8812) POLID, NASP, THDES(1), THDES(NDTH), NVOID, ID
      WRITE(43,8812) POLID, NASP, THDES(1), THDES(NDTH), NVOID, ID
```

```
8812 FORMAT (3A4,I6, 2F7.1, I4,30X,    7H      P ,I6 )
     IF (NVOID .EQ. 0)       GO TO 491
     ID = ID + 1
     GO TO (492,493,494,495,496) , NVOID
 492 WRITE (6,75 )  ( VOIDL(I), VOIDH(I), I = 1,NVOID), ID
     WRITE(43,75 )  ( VOIDL(I), VOIDH(I), I = 1,NVOID), ID
7500 FORMAT (  2F6.1 , 54X , 7H      P ,I6)
     GO TO 491
 493 WRITE (6,7510)  ( VOIDL(I), VOIDH(I), I = 1,NVOID), ID
     WRITE(43,7510)  ( VOIDL(I), VOIDH(I), I = 1,NVOID), ID
7510 FORMAT (  4F6.1 , 42X , 7H      P ,I6)
     GO TO 491
 494 WRITE (6,752 )  ( VOIDL(I), VOIDH(I), I = 1,NVOID), ID
     WRITE(43,752 )  ( VOIDL(I), VOIDH(I), I = 1,NVOID), ID
7520 FORMAT (  6F6.1 , 30X , 7H      P ,I6)
     GO TO 491
 495 WRITE (6,753 )  ( VOIDL(I), VOIDH(I), I = 1,NVOID), ID
     WRITE(43,753 )  ( VOIDL(I), VOIDH(I), I = 1,NVOID), ID
7530 FORMAT (  8F6.1 , 18X , 7H      P ,I6)
     GO TO 491
 496 WRITE (6,754 )  ( VOIDL(I), VOIDH(I), I = 1,NVOID), ID
     WRITE(43,754 )  ( VOIDL(I), VOIDH(I), I = 1,NVOID), ID
7540 FORMAT ( 10F6.1 ,  6X , 7H      P ,I6)
C
 491 CONTINUE
C
     RMAX = -1000.
     RMIN = +1 00.
     ISET = 1
     ITH =
 500 ITH = ITH + 1
     ECL =
     ID  = ID  + 1
     IF ( CKSAT(ITH) .GT.  .0 ) GO TO 510
     IF (NVOID .EQ. 0)       GO TO 506
     DO 5 5  J = 1,NVOID
     IF (THDES(ITH) .GT. VOIDL(J)  .AND. THDES(ITH) .LT. VOIDH(J) )
    1GO TO 8 9
 505 CONTINUE
 506 CONTINUE
     WRITE (6,8813) THDES(ITH) ,IP ,ID
     WRITE(43,8813) THDES(ITH) ,IP ,ID
8813 FORMAT (F 0.1,9X,1H ,20X,I10.16X,    7H      P, I6)
     GO TO 81
C
 809 ID = ID - 1
     GO TO 81
C
 510 IF ( NPN(ITH) .GT. 1 )  GO TO 520
     IF (NPN(ITH) .EQ. 0)  GO TO 527
     IF ( INPN(ITH,1) .EQ. 1)  GO TO 527
     NEND = NPN(ITH)
```

```
      ECL = 1
      THT = THDES(ITH)
      SS(1)     = S(ITH,1)
      RR(1)     = R(ITH,1)
      IINPN(1) = INPN(ITH,1)
      GO TO 528
  527 CONTINUE
      WRITE (6,8814) THDES(ITH) ,IP ,ID
      WRITE(43,8814) THDES(ITH) ,IP ,ID
 8814 FORMAT (F10.1,9X,1H1,20X,I10.16X,   7H       P,I6)
      GO TO 81
C
  520 CONTINUE
      THT  = THDES(ITH)
      NEND = NPN(ITH)
      CALL        REORG( ITH )
      DO 525 III=1,NEND
      R(ITH,III) = RR(III)
      S(ITH,III) = SS(III)
      INPN(ITH,III) = IINPN(III)
      IF( IINPN(III) .EQ. 2 ) ECL = ECL + 1
  525 CONTINUE
  528 CONTINUE
      WRITE (6,8815) THDES(ITH) ,NEND ,ECL ,IP ,ID
      WRITE(43,8815) THDES(ITH) ,NEND ,ECL ,IP ,ID
 8815 FORMAT (F10.1,9X,1H1,I10,F10.3,I10,16X, 7H       P,I6)
      ITEST = NEND + 5
      NE =
  530 KS = NE + 1
      ID = ID + 1
      ITEST = ITEST - 5
      IF( ITEST .GT. 5 ) GO TO 806
      GO TO (801,802,803,804,805),ITEST
  801 WRITE (6,8801)( IINPN(J) ,RR(J) ,SS(J) , J=KS,NEND),ID
      WRITE(43,8801)( IINPN(J) ,RR(J) ,SS(J) , J=KS,NEND),ID
 8801 FORMAT( 1X,  (I1,F6.1,F5.1,1X), 52X,  7H       P ,I6)
      GO TO 81
  802 WRITE (6,8802)( IINPN(J) ,RR(J) ,SS(J) , J=KS,NEND),ID
      WRITE(43,8802)( IINPN(J) ,RR(J) ,SS(J) , J=KS,NEND),ID
 8802 FORMAT( 1X, 2(I1,F6.1,F5.1,1X), 39X,  7H       P ,I6)
      GO TO 81
  803 WRITE (6,8803)( IINPN(J) ,RR(J) ,SS(J) , J=KS,NEND),ID
      WRITE(43,8803)( IINPN(J) ,RR(J) ,SS(J) , J=KS,NEND),ID
 8803 FORMAT( 1X, 3(I1,F6.1,F5.1,1X), 26X,  7H       P ,I6)
      GO TO 81
  804 WRITE (6,8804)( IINPN(J) ,RR(J) ,SS(J) , J=KS,NEND),ID
      WRITE(43,8804)( IINPN(J) ,RR(J) ,SS(J) , J=KS,NEND),ID
 8804 FORMAT( 1X, 4(I1,F6.1,F5.1,1X), 13X,  7H       P ,I6)
      GO TO 81
  805 WRITE (6,8805)( IINPN(J) ,RR(J) ,SS(J) , J=KS,NEND),ID
      WRITE(43,8805)( IINPN(J) ,RR(J) ,SS(J) , J=KS,NEND),ID
 8805 FORMAT( 1X, 5(I1,F6.1,F5.1,1X),        7H       P ,I6)
```

```
      GO TO 81
  806 CONTINUE
      NE = KS + 4
      WRITE (6,885)( IINPN(J) ,RR(J) ,SS(J) , J=KS,NE  ),ID
      WRITE (7,885)( IINPN(J) ,RR(J) ,SS(J) , J=KS,NE  ),ID
C
      IF( ITEST .GT. 0 ) GO TO 530
C
  810 CONTINUE
  536 CONTINUE
  538 CONTINUE
      IF (KMISS .EQ. 0)   GO TO 699
      WRITE (6,8900) (REFMIS(J),J= 1,KMISS)
 8900 FORMAT (//31H ********************************* /
     1        31H ********************************* /
     2 29H0THE VALUE OF THE REF. FOUND AT THE PREVIOUS SWEEP WAS USED AT
     3THE FOLLOWING ASPECT ANGLES    //, (F10.1) )
      WRITE (6,8910)
 8910 FORMAT (//31H ********************************* /
     1        31H ********************************* //)
C
  899 CONTINUE
      JMISS =
      KMISS =
  700 CONTINUE
      CALL EXIT
      GO TO 5
      END
      FUNCTION FUNC(A,B)
      AA = A/10.
      FUNC = 10.*ALOG10(AA*AA - B*B)
      RETURN
      END
      SUBROUTINE SPECT3
      COMMON/BLOCK1/CKSAT(361), CKITH(4,361),LAST,IVARRF,THOLD,IRO,DRANG
     1, IRS , IA , IRSTRT , ICTRL , VSTD , ITH, CONST , SAT , IMODE ,
     2  SIGCAL , CKONE(361) , ANOISE
C
      COMMON/BLOCK2/  NS(361)         ,ISB(361,10)    ,ISNCT(361,10)  ,
     1INTST(361,10)  ,ISPCT(361,10)  ,ISE(361,10)    ,SIG(540)
      COMMON/BLOCK4/  INPN(361,30)    ,R(361,30)      ,S(361,3 )      ,
     1NPN(361)       ,IINPN(    30)  ,RR(    30)     ,SS(    3 )
C
C
      COMMON/BLOCK5/  IREGBN(10)     ,IREGND(10)
C
      DIMENSION
     1   ISBB(1 ),  ISEE(1 ),  ISNCTT(10),  ISPCTT(10),  INTSTT(10)
      DIMENSION  ISMOTH(10)
      IREG =
      IKEN =
      IDROP =
```

```
      ICONT =
      IBTH  = 
      NPASS = 1
      ISPASS = 
      NSATT  = NS(ITH)
      NS(ITH)=
      LAST1 = LAST + 12
      WRITE (6,9001)  (SIG(J), J= LAST,LAST1)
 9001 FORMAT ( 20F6.2 )
      GO TO (8  ,90 ),ICTRL
C
  800 IF ( CKSAT(ITH) )  790,910,790
  790 IF ( CKONT(ITH) .EQ.  .  )    GO TO 800
C
  910 CONTINUE
      DO 92   IJ = 1,NSATT
      ISBB  (IJ) = ISB  (ITH,IJ)
      ISEE  (IJ) = ISE  (ITH,IJ)
      ISNCTT(IJ) = ISNCT(ITH,IJ)
      ISPCTT(IJ) = ISPCT(ITH,IJ)
      ISMOTH(IJ) =
  920 INTSTT(IJ) = INTST(ITH,IJ)
C
      DO 922  JK = 1,10
      ISE(ITH,JK) =
  922 CONTINUE
      WRITE (6,90 6) NSATT
 9006 FORMAT (17H LOOP ON NSATT = , I3 )
      IJ =
  921 IJ = IJ + 1
      ISPASS = 
      IR     = ISBB(IJ) + IRS
      IREND = ISEE(IJ) + IRS
      IRBBB = IR
      NPINSA = IREND - (IRBEB+1)
      WRITE(6,6 1 )  NPINSA
 6010 FORMAT (33H NUMBER OF POINTS IN SATURATION = , I5)
      IF (NPINSA .GT. 3 )          GO TO  9
      GO TO (11,12,13), NPINSA
   11 IF (ISPCTT(IJ) .GE. 3 )     GO TO 51
      GO TO 399
   51 NPN(ITH) = NPN(ITH) + 1
      ISUBS1 = NPN(ITH)
      INPN(ITH,ISUBS1) = 2
      R    (ITH,ISUBS1) = FLOAT(IRBBB+1-IRS) * DRANG
      VPT = SIG(IRBBB+1)
      WRITE (6,70 0)  R(ITH,ISUBS1)
 7000 FORMAT (2 H PEAK PLACED AT R = , F8.2 )
      IF (VPT .LE. ANOISE) VPT = ANOISE + 1.0
      IF (INODE .EQ. 1)    VPT = FUNC(VPT ,CONST)
      S    (ITH,ISUBS1) = VPT + SIGCAL
      GO TO 399
```

```
   12 IF (ISPCTT(IJ) .GE. 2 )      GO TO 52
      GO TO 399
   52 NPN(ITH) = NPN(ITH) + 1
      ISUBS1 = NPN(ITH)
      INPN(ITH,ISUBS1) = 2
      R    (ITH,ISUBS1) = FLOAT(IRBBB+2-IRS)* DRANG
      WRITE (6,70 0)  R(ITH,ISUBS1)
      VPT = SIG(IRBBB+2)
      IF (VPT .LE. ANOISE) VPT = ANOISE + 1.0
      IF (IMODE .EQ. 1)    VPT = FUNC(VPT,CONST)
      S    (ITH,ISUBS1) = VPT + SIGCAL
      GO TO 399
   13 IF (ISPCTT(IJ) .GE. 2 )      GO TO 53
      GO TO 399
   53 NPN(ITH) = NPN(ITH) + 1
      ISUBS1 = NPN(ITH)
      INPN(ITH,ISUBS1) = 2
      TOP = SIG(IRBBB+1)
      JR1 = 1
      IF (SIG(IRBBB+2) .LT. TOP)     GO TO 54
      TOP = SIG(IRBBB+2)
      JR1 = 2
   54 IF (SIG(IRBBB+3) .LT. TOP)     GO TO 55
      TOP = SIG(IRBBB+3)
      JR1 = 3
   55 R    (ITH,ISUBS1) = FLOAT(IRBBB+JR1-IRS) * DRANG
      WRITE (6,70 0) R(ITH,ISUBS1)
      I3 = IRBBB+JR1
      VPT = SIG(I3)
      IF (VPT .LE. ANOISE) VPT = ANOISE + 1.0
      IF (IMODE .EQ. 1)    VPT = FUNC(VPT,CONST)
      S    (ITH,ISUBS1) = VPT + SIGCAL
      GO TO 399
C
C
    9 ICNN = ISPCTT(IJ)
      INT = INTSTT(IJ)
      ICP = ISNCTT(IJ) - 1
      II1 = ICP + 1
      WRITE (6,90 7) IJ,IR,IREND,INT,II1
 9007 FORMAT ( 8H REGION ,I4,11H IR SET TO ,I4,11H RUN TO IR , I4,
     1         8H  INT = ,I4, 7H ICP = , I4  )
C
      GO TO 10
C
  800 CONTINUE
      DO 81   JK =  ,1
      ISE(ITH,JK) =
  810 CONTINUE
      IR = IRSTRT - 1
      ICN    =
      ICP    =
```

```
      INT    = 1
      IREND = LAST
    5 IR = IR + 1
      ICONT = ICONT + 1
      IF( SIG(IR) .GT. THOLD ) GO TO 6
      IF( IR .LT. IREND ) GO TO 5
      GO TO 4
    6 IF( IR .LE. 1 ) GO TO 5
   10 ICP = ICP + 1
   15 CONTINUE
      IF( ICP .EQ. 3 .AND. INT .EQ. 1 ) GO TO 20
      GO TO 25
   20 NPN(ITH) = NPN(ITH) + 1
      ISUBS1 = NPN(ITH)
      INPN(ITH,ISUBS1) = 1
      R    (ITH,ISUBS1) = FLOAT(IR-IRS-3) * DRANG
      VPT = SIG(IR-3)
      IF (VPT .LE. ANOISE)  VPT = ANOISE + 1.0
      IF (IMODE .EQ. 1)   VPT = FUNC(VPT,CONST)
      S    (ITH,ISUBS1) = VPT + SIGCAL
      INT =
      GO TO (19,225), ICTRL
  225 IF (CKONE(ITH) .EQ.  .0)  GO TO 25
   19 CONTINUE
      IF ( NPN(ITH) .EQ. 1 )  GO TO 25
      KNPN = NPN(ITH) - 1
      IF ( INPN(ITH,KNPN) .EQ. 2 )      GO TO 25
      IF (R(ITH,ISUBS1) .EQ. R(ITH,KNPN) )  GO TO 221
      IRBEGN = R(ITH,KNPN)/DRANG + 0.9 + FLOAT(IRS)
      IF ( SIG(IR) .GT. THOLD )         GO TO 21
      IIR = IR
      GO TO 22
  221 NPN(ITH) = NPN(ITH) - 1
      GO TO 25
   21 IIR = IR - 3
   22 IF ( NS(ITH) .EQ. 0 )  GO TO 222
      IRNULL = IRBEGN - IRS
      IF (ISUB(ITH,NSUBS1) .GT. IRNULL ) GO TO 25
  222 WRITE (6,6000)
 6000 FORMAT (36H ** NO PEAK FOUND BETWEEN TWO NULLS  )
      IF ( (IIR-(IRBEGN+1)) .GE. 7 )  GO TO 23
      WRITE (6,6020)
 6020 FORMAT (32H 7 POINTS WERE NOT ABOVE THOLD    )
      GO TO 25
   23 JJBEGN = IRBEGN + 1
      JJEND = IRBEGN + 7
      DO 24  IIJK = JJBEGN, JJEND
      IF ( SIG(IIJK) .GT. THOLD )       GO TO 24
      WRITE (6,6030)
 6030 FORMAT (45H 7 CONSC. POINTS ABOVE THOLD WERE NOT FOUND  )
      GO TO 25
   24 CONTINUE
```

```
C
      IREG = IREG + 1
      IREGBN(IREG) = IRBEGN
      IREGND(IREG) = IIR
      WRITE (6,6060) IRBEGN, IIR
 6060 FORMAT (23H LOCATE A PEAK BETWEEN , I5, 5H AND , I5 )
C
   25 IR = IR + 1
      ICONT = ICONT + 1
      GO TO (27,26),ICTRL
   26 IF (IR .GT. IREND)   GO TO 226
      GO TO 28
  226 IF (SIG(IREND) .LT. SAT)      GO TO 228
      ISE(ITH,NSUBS1) = IR - IRS
      ICN = 3
      ICP =
      WRITE (6,9004)  NS(ITH),ISNCT(ITH,NSUBS1),INTST(ITH,NSUBS1) ,
     1               ISB(ITH,NSUBS1), ISE(ITH,NSUBS1)
      GO TO 398
  228 IPT = 1
      ICN =
      GO TO 3
  227 IF (SIG(IREND) .LT. SAT)  GO TO 400
  534 CONTINUE
      ISE(ITH,NSUBS1) = IR - IRS
      ICN = 3
      ICP =
      WRITE (6,9004)  NS(ITH),ISNCT(ITH,NSUBS1),INTST(ITH,NSUBS1) ,
     1               ISB(ITH,NSUBS1), ISE(ITH,NSUBS1)
      IF ( IDROP .EQ. 0)  GO TO 400
      IF (NPN(ITH) .EQ. 0) GO TO 400
      IF ( R(ITH,ISUBS1) .GT. (ISB(ITH,NSUBS1) * DRANG )  .AND.
     1     R(ITH,ISUBS1) .LT. (ISE(ITH,NSUBS1) * DRANG ) )
     2     NPN(ITH) = NPN(ITH) - 1
      ISUBS1 = NPN(ITH)
      IDROP =
      GO TO 4
   27 CONTINUE
      IF (IR .GT. IREND)  GO TO 227
   28 CONTINUE
      IF (SIG(IR) .GE. SAT)  GO TO 30
      IF (SIG(IR) - SIG(IR-1) )  40,29,29
   29 IF (IDROP .EQ. 1) GO TO 25
      GO TO 1
   30 GO TO (35,25), ISPASS
   35 NS(ITH) = NS(ITH) +
      NSUBS1 = NS(ITH)
      ISB(ITH,NSUBS1) = IR-IRS-1
      ISNCT(ITH,NSUBS1) = ICP
      INTST(ITH,NSUBS1) = INT
      ISPASS = 2
      WRITE (6,9003) IR,ICONT
```

```
9003 FORMAT (20H SATURATE AT SAMPLE , I3 ,12H , ICOUNT = ,I3 )
     GO TO 25
  40 IF ( SIG(IR+2) .GE. SIG(IR-1))  GO TO 143
     IF (ISPASS .EQ. 1 )  GO TO 50
     IF (ICTRL .EQ. 2)   GO TO 41
     IF ((IREND-IR) .GT. 5)  GO TO 533
     IR = IREND
     GO TO 534
 533 CONTINUE
     IF ( ((IR-IRS) - ISB(ITH,NSUBS1)) .LT. 25 ) GO TO 41
     IF ( SIG(IR+6) .GT. SAT  .OR.  SIG(IR+9) .GT. SAT )  GO TO 42
     IF (SIG(IR+12) .LT. SAT) GO TO 41
     IDROP = 1
     GO TO 25
  42 CONTINUE
     IDROP =
     GO TO 25
  41 CONTINUE
     ISE(ITH,NSUBS1) = IR-IRS
     ICP =
     JJ1 = NS(ITH)
     WRITE (6,9004) JJ1,ISNCT(ITH,JJ1),INTST(ITH,JJ1),ISB(ITH,JJ1),
    1               ISE(ITH,JJ1)
9004 FORMAT ( 8H NSATT = ,I4,8H  ICP =,I4,8H  INT = , I4,
    1         7H ISB = ,  I4,7H  ISE =,I4  )
     IF (IDROP .EQ.  )  GO TO 50
     IF (NPN(ITH) .EQ. 0) GO TO 50
     IF (R(ITH,ISUBS1) .GT. (ISB(ITH,NSUBS1) * DRANG) .AND.
    1    R(ITH,ISUBS1).LT. (ISE(ITH,NSUBS1) ) )
    2     NPN(ITH) = NPN(ITH) - 1
     ISUBS1 = NPN(ITH)
     IDROP =
C
  50 CONTINUE
     IPT =
     IF( ICP .GE. 3 ) IPT = 1
     ICN =
C
 110 ICN = ICN + 1
     IF( ICN .EQ. 3 .AND. IPT .EQ. 1 ) GO TO 120
     GO TO 125
 120 NPN(ITH) = NPN(ITH) + 1
     INPN(ITH,ISUBS1) = 2
     R   (ITH,ISUBS1) = FLOAT(IR-IRS-3) * DRANG
     VPT = SIG(IR-3)
     IF (VPT .LE. ANOISE) VPT = ANOISE + 1.0
     IF (IMODE .EQ. 1)   VPT = FUNC(VPT,CONST)
     S   (ITH,ISUBS1) = VPT + SIGCAL
     IPT =
C
 125 IR = IR + 1
     ICONT = ICONT + 1
```

```
      IF (ICTRL .EQ. 1)       GO TO 145
      IF (IR .GT. IREND)      GO TO 300
      GO TO 155
  143 IF ( SIG(IR+2) .GE. SAT )   GO TO 25
      IF (IDROP .EQ. 1) GO TO 25
      GO TO 1
  145 IF (IR .GT. IREND)      GO TO 400
  155 CONTINUE
      IF (IA .GT. 1)  GO TO 157
  162 IF ( SIG(IR) .GT. THOLD ) GO TO 165
      IBTH = IBTH + 1
      IF (ICN .LT. 3)         GO TO 125
      IF (NPASS .EQ. 2)       GO TO 125
C
      NPN(ITH) = NPN(ITH) + 1
      ISUBS1 = NPN(ITH)
      INPN(ITH,ISUBS1) = 1
      R   (ITH,ISUBS1) = FLOAT(IR-IRS) * DRANG
      VPT = SIG(IR)
      IF (VPT .LE. ANOISE)  VPT = ANOISE + 1.0
      IF (IMODE .EQ. 1)   VPT = FUNC(VPT,CONST)
      S   (ITH,ISUBS1) = VPT + SIGCAL
      NPASS = 2
      GO TO 125
  157 IF ( CKONE(ITH) .EQ. 0.0 )        GO TO 165
      IF (CKSAT(ITH) .EQ. (-1. ) )  GO TO 162
C
  165 IF ( SIG(IR) .LE. SIG(IR-1) )  GO TO 110
      IF (SIG(IR+2) .LE. SIG(IR-1))   GO TO 110
      IF(ISPASS .EQ. 1)               GO TO 170
      ISPCT(ITH,NSUBS1) = ICN
      ISPASS = 1
      WRITE (6,9005) ISPCT(ITH,JJ1)
 9005 FORMAT (2H ICN = , I5 )
  170 INT = 2
C
      IF( ICN .GE. 3) INT = 1
      IF( IBTH .EQ. 0 ) GO TO 140
      IBTH =
      NPASS= 1
      INT  = 1
  140 ICP  = 1
      GO TO 15
C
C
  300 CONTINUE
      IF (CKONE(ITH) .EQ. 1.0)    GO TO 400
      IF (ICN .LT. 3  .AND.  IPT .EQ. 1)  GO TO 180
      GO TO 398
  180 IF (ISPCTT(IJ) .GT. 1)  GO TO 190
      GO TO 398
  190 ISPCTT(IJ) = ISPCTT(IJ) - 1
```

```
      GO TO 11
C
  398 CONTINUE
      IF (ICKONT(ITH) .EQ. 1.)    GO TO 400
      IF (ISMOTH(IJ) .GT. 1)      GO TO 399
      IRQUES = H(ITH,ISUBS1)/DRANG + 0.9 + FLOAT(IRS)
      IF ( IRQUES .GE. IRBBB  .AND.  IRQUES .LE. IREND )  GO TO 601
      IF ( NS(ITH) .EQ. 0 )  GO TO 600
      IISB = ISB(ITH,NSUBS1) + IRS
      IF (IISB .GT. IRBBB)   GO TO 399
  600 IRBGBN(IJ) = IRBBB
      IREGND(IJ) = IREND
      WRITE (6,6 4 ) IRBBB, IREND
 6040 FORMAT (23H NO PEAK FOUND BETWEEN  , I5, 5H AND , I5,11H SAT REGIO
     1N )
      CALL        SMOOTH( IJ, IR, IREND )
      ISMOTH(IJ) = 1
      INT = INTSTT(IJ)
      ICP = ISNCTT(IJ) - 1
      ISPCTT(IJ) = ICNN
      ISPASS = 1
      NPASS  = 1
      GO TO 10
C
  601 INPNN = INPN(ITH,NSUBS1)
      GO TO (6 2,399), INPNN
  602 CONTINUE
      IF (NS(ITH) .EQ. 0)  GO TO 603
      IISB =  ISB (ITH,NSUBS1) + IRS
      IF (IISB .GT. IRQUES)   GO TO 399
  603 CONTINUE
      IRBGBN(IJ) = IREND
      WRITE (6,6 7 ) IRQUES, IREND
 6070 FORMAT (26H XXXXX PEAK FOUND BETWEEN  ,I5, 5H AND , I5,47H NULL WA
     1S LAST THING BETWEEN SAT. POINTS XXXXX  )
      IREGND(IJ) = IREND
      CALL        SMOOTH( IJ, IR, IREND )
      ISMOTH(IJ) = 1
      ICP =
      INT =
      ISPASS = 1
      NPASS =
      GO TO
  399 CONTINUE
      IF (ISPASS .EQ. 1)  GO TO 1399
      IF ( ISE(ITH,NSUBS1) .LE. ISB(ITH,NSUBS1)) GO TO 1397
      ISPCT(ITH,NSUBS ) = ICN
      ISPASS = 1
      WRITE (6,9 5) ICN
      GO TO 1399
 1397 ISE (ITH,NSUBS1) = IREND - IRS
      ICP =
```

```
      ICN = 3
      ISPCT(ITH,NSUBS1) = ICN
      ISPASS = 1
      WRITE (6,9004) NS(ITH), ISNCT(ITH,NSUBS1), INTST(ITH,NSUBS1) ,
     1                        ISB(ITH,NSUBS1),   ISE(ITH,NSUBS1)
      WRITE (6,9005)  ICN
 1399 CONTINUE
      IF (IJ .LT. NSATT)  GO TO 921
  400 CONTINUE
      IF( ISPASS .EQ. 1 ) GO TO 401
      IF ( ISE(ITH,NSUBS1) .LE. ISB(ITH,NSUBS1) )  GO TO 1400
      ISPCT(ITH,NSUBS1) = ICN
      WRITE (6,9005)  ICN
      ISPASS = 1
      GO TO 401
 1400 ISE (ITH,NSUBS1) = IREND - IRS
      ICP = 0
      ICN = 3
      ISPCT(ITH,NSUBS1) = ICN
      ISPASS = 1
      WRITE (6,9004) NS(ITH), ISNCT(ITH,NSUBS1), INTST(ITH,NSUBS1) ,
     1                        ISB(ITH,NSUBS1),   ISE(ITH,NSUBS1)
      WRITE(6,9005) ICN
  401 CONTINUE
C
      IF ( IREG .EQ. 0 )      RETURN
      IKEN = IKEN + 1
      IF ( IKEN .GT. IREG )  RETURN
C
      CALL        SMOOTH( IKEN, IR, IREND )
C
      ICP = 0
      INT =
      ISPASS = 1
      NPASS =
      GO TO
C
  500 RETURN
      END
      SUBROUTINE SMOOTH( IKEN, IR, IREND )
C
      COMMON/BLOCK2/  NS(361)          ,ISB(361,10)     ,ISNCT(361,10)   ,
     1INTST(361,10)   ,ISPCT(361,10)   ,ISE(361,10)     ,SIG(54 )
      COMMON/BLOCK5/  IREGBN(1 )     ,IREGND(10)
      DIMENSION       AVG(3 )
C
      IREONE = IREGBN(IKEN) - 1
      IRETWO = IREGND(IKEN) -
      ICOUNT =
      DO 1    IRR = IREONE,IRETWO
      ICOUNT = ICOUNT + 1
      ONE    = SIG(IRR)
```

```
      IRR1 = IRR + 1
      TWO   = SIG(IRR1)
      THREE = SIG(IRR+2)
      AVG(ICOUNT) = ( ONE + TWO + THREE )/3.0
  100 CONTINUE
      DO 200   IRJ = 1, ICOUNT
      IRSUB1 = IRECNE + IRJ
      SIG(IRSUB1) = AVG(IRJ)
  200 CONTINUE
      IB    = IREGBN(IKEN)
      IRENI = IREGND(IKEN)
      RETURN
      END
      SUBROUTINE REORG( I    )
C
      COMMON/BLOCK4/  INPN(361,30)    ,R(361,30)       ,S(361,30)
     1NPN(361)       ,IINPN(    30)   ,RR(    30)      ,SS(    30)
C
C
      ISEQ =
   10 ISEQ = ISEQ + 1
      J =
      JL=
      RR   (ISEQ) = R    (I,J)
      SS   (ISEQ) = S    (I,J)
      IINPN(ISEQ) = INPN(I,J)
   20 J = J + 1
      IF( R(I,J) .GE. RR(ISEQ) ) GO TO 30
      RR   (ISEQ) = R    (I,J)
      SS   (ISEQ) = S    (I,J)
      IINPN(ISEQ) = INPN(I,J)
      JL = J
   30 IF( J .LT. NPN(I) ) GO TO 20
      R(I, L)= 1 .
      IF( ISEQ .LT. NPN(I)) GO TO 10
C
      RETURN
      END
      SUBROUTINE  SUBIRS ( DATA, IRSS , VSTDI , IR1, IR2 )
C
      DIMENSION  DATA(540)
C
      IR = IR1
      IRSS = IR1
   10 IR = IR + 1
      IF ( DATA(IR) .GT. DATA(IRSS) )  IRSS = IR
      IF ( IR .LT. IR2 )  GO TO 10
      VSTDI = DATA(IRSS)
      RETURN
      END
       SYMDEF  DATAIN
       BLOCK   INPUT
```

```
INDAT   BSS     3.9
IEOF    BSS     1
        USE     PREVIOUS
DATAIN  SAVE
        LDA     DCW
        STA     DCW
        MME     GETNOS
        RTD
        ZERO    FA,DCW
        ZERO    STATR
        MME     GEROAD
        LDA     STATR
        ANA     =0.7 0 000  0
        CMPA    =0.4 0 000  0
        TZE     EOF
        LDA     = ,DL
        TRA     RETURN
EOF     LDA     =1,DL
RETURN  STA     IEOF
        RETURN  DATAIN
FA      BCI     1, 0 8
STATR   BSS     2
DCW1    IOTL    INDAT,309
DCW     BSS     1
        END
      MODEL  66  SPECT  TEST                              8 9.0     1 19
 0.494     22.        0.5          75.0
    3     1     6  3 6  934  45     50    30    80
    1
 VERT/VERT                                  0
    2
 0.0      1-38.5 15.      1-38.5
 0.0        .
 0.0        .
```

SECTION IX

CLASS

```
C          RADSIN CLASSIFIER                    4
      COMMON  X(6), NMODE(10), W(10,10,6), TH(10,10), GMAX, ICAT, MODE,
     1NC, ID
      DIMENSION IID(6), LVEC(6), ASP(200), VC(200,7), VCTR(200,6),
     1NCONF(10),
     2PIGH(10), NCAT(10,10),P(10,10,10),IC(10,10,10,10)
      DIMENSION TGTID(12)
      DIMENSION NVECTR(10,10)
   10 CONTINUE
      READ (5, 1000) NC, NDIM, NUNKWN
 1000 FORMAT (3I5)
      WRITE (6, 1001) NC, NDIM, NUNKWN
 1001 FORMAT(1H ,34HNO. OF TARGETS USED IN TRAINING...,I2,33H...DIMENSIORR5  1
     1N OF DECISION SPACE....I2, 3H.../1H ,41HNO. OF UNKNOWN TARGETS TO
     2BE PROCESSED....I3, 3H...)
      IF (NC.GT. .AND.NC.LE.10.AND.NDIM.GT.0.AND.NDIM.LE.6 .AND.NUNKWN
     1.GT.0) GO TO 11
      WRITE (6, 1002)
 1002 FORMAT(1H ,72HNC AND NDIM MUST BE .GT. ZERO AND .LE. TEN AND NUNKWRR5  1
     1N MUST BE .GT. ZERO.)
      CALL EXIT
   11 CONTINUE
      READ (5, 1003) (NMODE(I), I = 1, NC)
      WRITE (6, 1003)
 1003 FORMAT(1H ,25HCATEGORY     NO. OF MODES)
      WRITE (6, 1004) (I, NMODE(I), I = 1, NC)
 1004 FORMAT (5X, I2, 12X, I2)
      DO 12 I = 1, NC
      IF (NMODE(I).GT.0.AND.NMODE(I).LE.10) GO TO 12
      WRITE (6, 1005)
 1005 FORMAT(1H ,39HNMODE(I) MUST BE .GT. ZERO AND .LE. TEN)
      CALL EXIT
   12 CONTINUE
      DO 30 I = 1, NC
      NMD = NMODE(I)
      READ (5, 1006) TGTID
 1006 FORMAT (12A4)
      WRITE (6, 1007) I, TGTID
 1007 FORMAT(1H , 8HCATEGORY,I4, 9H  ....  , 12A4/)
      DO 20 L = 1, NMD
      READ (5, 1008) (W(L,I,J), J = 1, NDIM)
 1008 FORMAT( 6F10.0)
      READ  (5,1020) TH(L,I),NVECTR(I,L)
 1020 FORMAT(F10.0,I5)
      WRITE (6, 1009) L
 1009 FORMAT(1H ,11HMODE NUMBER,I2/)
      WRITE (6, 1010) (W(L,I,J), J = 1, NDIM)
 1010 FORMAT(1H ,24HWEIGHT VECTOR COMPONENTS,/1H ,10F10.2)
      WRITE (6,1011) TH(L,I),NVECTR(I,L)
 1011 FORMAT(1H ,12HTHRESHOLD = ,F10.2,14HNVECTR(I,L) = ,I5/)
C
   20 CONTINUE
```

```
   30 CONTINUE
      DO 34 I=1,10
      PIGH(I) =  .
      DO 33 J=1,10
      NCAT(I,J) =
      DO 32 K=1,10
      P(I,J,K) = 0.
      DO 31 L=1,10
      IC(I,J,K,L) =
   31 CONTINUE
   32 CONTINUE
   33 CONTINUE
   34 CONTINUE
C
      READ (5, 1000) (NCONF(I), I = 1, NC)
      WRITE (6, 1013)
 1013 FORMAT(1H ,48HCATEGORY      NO. OF NONZERO ELEMENTS OF C MATRIX/)
      WRITE (6, 1014) (I, NCONF(I), I = 1, NC)
 1014 FORMAT (5X,I2, 20X, I1 )
      NNSUM =
      DO 36 I=1,NC
   36 NNSUM = NNSUM + NCONF(I)
      DO 40 II = 1, NC
      NCF = NCONF(II)
      IF (NCF.EQ.0) GO TO 4
      READ  (5,1 15)(I,J,K,L, IC(I,J,K,L),KK=1,NCF )
 1015 FORMAT( 4(2X,4I2,I5) )
   40 CONTINUE
      WRITE (6, 1017)
 1017 FORMAT(1H ,24H  I  J  K  L  C(I,J,K,L)/)
      IF( NNSUM .EQ.    ) GO TO 81
      DO 80 I = 1, NC
      NMD = NMODF(I)
      DO 70 J = 1, NMD
      DO 60 K = 1, NC
      NNMD = NMODE(K)
      DO 50 L = 1, NNMD
      IF( IC(I,J,K,L) .EQ.    ) GO TO 50
      WRITE (6,2 16) I,J,K,L, IC(I,J,K,L)
2016 FORMAT( 4(1X,I2),4X,I5 )
   50 CONTINUE
   60 CONTINUE
   70 CONTINUE
   80 CONTINUE
   81 CONTINUE
      DO 15  I=1,NC
      DO 14  J=1,NC
       NMD = NMODE(J)
       DO 13  K=1,NMD
       SUMN =  .
       SUML =  .
       IF( J .EQ. I ) GO TO 104
```

```
      NNMD = NMODE(I)
      DO 105 LP=1,NNMD
      SUMN = SUMN + IC(I,LP,J,K)
  105 CONTINUE
      DO 115 M=1,NC
      IF (M .EQ. J) GO TO 115
      LMD = NMODE(M)
      DO 110 L=1,LMD
      SUMD = SUMD + IC(M,L,J,K) - IC(J,K,M,L)
  110 CONTINUE
  115 CONTINUE
C
      P(I,J,K) =   SUMN/( NVECTR(J,K) + SUMD )
      GO TO 130
C
  104 CONTINUE
      DO 125 M=1,NC
      IF( M .EQ. I ) GO TO 125
      LMD = NMODE(M)
      DO 120 L=1,LMD
      SUMN = SUMN + IC(M,L,I,K)
      SUMD = SUMD + IC(M,L,I,K) - IC(I,K,M,L)
  120 CONTINUE
  125 CONTINUE
C
      P(I,I,K) =  1. -  SUMN/(NVECTR(I,K) + SUMD )
  130 CONTINUE
  140 CONTINUE
  150 CONTINUE
C
C
C
      DO 160 I=1,NC
      WRITE (6,2050) I
 2050 FORMAT(1H ,38HCONDITIONAL PROBABILITIES FOR CATEGORY,I2)
      DO 155 J=1,NC
      WRITE (6,2055) J, (P(I,J,K),K=1,10)
 2055 FORMAT(1H , 8HCATEGORY,I2,4X,10F8.4 )
  155 CONTINUE
  160 CONTINUE
      IPROB =
  700 IPROB = IPROB + 1
      DO 91 I1=1,10
      PIGH(I1) = 0.
      DO 90 J1=1,10
      NCAT(I1,J1) = 0
   90 CONTINUE
   91 CONTINUE
      READ  (5,1000) NSIG,NPDES,(IID(J),J=1,5)
C
      ID = 0
      DO 710 J2=1,5
```

```
      IF( IID(J21) .EQ. 0 ) GO TO 701
      ID = ID + 1
      LVEC(ID) = J21
  701 CONTINUE
      READ  (5,9520) TGTID
      WRITE (6,9520) IPROG, TGTID
 9520 FORMAT('1H ',25HDISCRIMINANTS FOR UNKNOWN,I2,4H ...,12A4)
C
      DO 703 NTT=1,NSIG
      READ  (5,9525) ASP(NTT), (VC(NTT,L),L=1,6)
 9525 FORMAT( F6. , 4X, 7F5.0 )
      IF( NPDES .EQ. 2 ) GO TO 706
      DO 702 J23=1,ID
      LLV = LVEC(J23)
      VCTR(NTT,J23) = VC(NTT,LLV)
  702 CONTINUE
      GO TO 815
  706 CONTINUE
      DO 710 J23=1,ID
      LLVEC = LVEC(J23)
      GO TO (801,802,803,804,805),LLVEC
  801 VCTR(NTT,J23) = AMAX1(VC(NTT,1),VC(NTT,4))
      GO TO 710
  802 VCTR(NTT,J23) = AMAX1(VC(NTT,2),VC(NTT,5))
      GO TO 710
  803 VCTR(NTT,J23) = AMAX1(VC(NTT,3),VC(NTT,6))
      GO TO 710
  804 VCTR(NTT,J23) = AMIN1(VC(NTT,3),VC(NTT,6))
      GO TO 710
  805 S1 = 10.**(VC(NTT,3)/20.)
      S2 = 10.**(VC(NTT,6)/20.)
      VCTR(NTT,J23) = ABS(S1-S2)/(S1+S2)
C
  710 CONTINUE
  815 WRITE (6,9530) ASP(NTT),(VCTR(NTT,L),L=1,ID)
 9530 FORMAT('0',1X,F8.2)
  703 CONTINUE
C
      WRITE (6,9500)
 9500 FORMAT('1H ',76HCLASSIFIED AS ** CAT1  CAT2  CAT3  CAT4  CAT5  CAT6
     *  CAT7  CAT8  CAT9  CAT10)
      WRITE (6,9501)
 9501 FORMAT('1H ',16HCATEGORY MODE **)
C
      DO 900 NTT=1,NSIG
C
      DO 820 J=1,ID
      X(J) = VCTR(NTT,J)
  820 CONTINUE
C
      CALL DECIDE
C
```

```
      NCAT(ICAT, MODE) = NCAT(ICAT, MODE) + 1
      DO 699 I = 1, NC
      NMD = NMODE(I)
      SUM = .
      DO 62  J = 1, NC
      NNMD = NMODE(J)
      DO 61  L = 1, NNMD
      SUM = SUM + FLOAT(NCAT(J,L))*P(I,J,L)
  610 CONTINUE
  620 CONTINUE
      PIGH(I) = SUM/FLOAT(NTT)
  699 CONTINUE
      WRITE (6,9510) ICAT,MODE,(PIGH(I),I=1,NC)
 9510 FORMAT(4X,I2,5X,I2,4H  **,F5.3,9(1X,F5.3))
C
  900 CONTINUE
      IF( IPROB .LT. NUNKWN ) GO TO 700
      GO TO 1
C
      END
      SUBROUTINE DECIDE
      COMMON  X(6), NMODE(1 ), W(10,10,6), TH(10,10), GMAX, ICAT, MODE,
     1NC, ID
      DIMENSION G(1 , 10)
      DO 2  I = 1, NC
      NMD = NMODE(I)
      DO 1  L = 1, NMD
      G(L,I) =  .
   10 CONTINUE
   20 CONTINUE
      DO 7  I = 1, NC
      NMD = NMODE(I)
      DO 6  L = 1, NMD
      DO 5  J = 1, ID
      G(L,I) = G(L,I) + X(J)*W(L,I,J)
   50 CONTINUE
      G(L,I) = G(L,I) + TH(L,I)
      IF (L.EQ. ) GO TO 55
      IF (G(L,I).LT.GMMAX) GO TO 60
   55 LODE = L
      GMMAX = G(L,I)
   60 CONTINUE
      IF (I.EQ. ) GO TO 65
      IF (GMMAX.LT.GMAX) GO TO 70
   65 ICAT = I
      MODE = LODE
      GMAX = GMMAX
   70 CONTINUE
      RETURN
      END
    3     2     1
    1     1     2
```

```
TRAINING TARGET NO. 1... MODEL A1/59
  4.608    45.88
-1063.115     51
TRAINING TARGET NO. 2... MODEL 8/19
  2.078    16.759
 -142.588     51
TRAINING TARGET NO. 3... MODEL 66
  2.111     9.8 5
 -50.301      36
  1.133      .630
   -0.842      15
    0     3
   2 1 3 1     3
  101     2     1     1
          MODEL    65                                                  9.  0     2     19
    0.0       2.   2 .8-18.7   2.   19.8-19.1   0.5
    0.5       2.   2 .8-18.3   2.    9.8-17.7   1.0
    1.0       2.   21.3-18.9   3.    8.8-17.6   2.0
    1.5       2.   2 .3-18.3   2.   20.3-18.0   1.0
    2.0       2.   2 .3-18.9   3.    9.3-20.8   1.5
    2.5       3.   19.8-21.3   3.   20.3-23.0   0.0
    3.0       3.   2 .3-2 .9   2.    9.3-25.7   19.8
    3.5       3.   19.3-22.5   3.    9.3-24.6   19.8
    4.0       3.   19.8-24.2   3.   24.2-26.5   1.0
    4.5       3.   19.8-26.7   2.    9.3-22.8   0.5
    5.0       3.   19.8-27.7   2.   20.3-21.5   19.8
    5.5       3.   21.7-27.0   2.    9.8-20.2   19.8
    6.0       3.   21.3-27.3   3.    9.8-20.8   19.8
    6.5       3.   21.3-27.3   3.    9.8-20.3   19.3
    7.0       2.   2 .3-27.1   3.    9.3-22.2   19.3
    7.5       2.   2 .8-27.9   3.    9.3-24.3   19.3
    8.0       2.   19.3-27.6   3.    8.8-25.3   18.3
    8.5       2.   19.8-27.7   3.    8.8-25.7   18.8
    9.0       3.   23.7-26.9   3.    9.3-24.0   19.3
    9.5       4.   23.7-27.5   2.    9.3-22.9   20.8
   10.0       4.   24.7-28.1   2.    9.3-22.0   20.3
   10.5       3.   24.2-27.5   2.    9.3-21.5   18.8
   11.0       3.   22.2-28.2   2.    8.3-23.1   18.3
   11.5       3.   23.7-27.3   2.    9.3-23.8   20.3
   12.0       3.   24.7-27.5   2.    9.3-25.3   20.3
   12.5       2.   22.7-27.2   2.    8.3-26.6   0.5
   13.0       2.   22.7-28.2   2.    8.3-26.6   0.5
   13.5       2.   23.2-28.0   4.   23.7-26.2   0.5
   14.0       3.   22.7-27.0   3.    8.8-26.1   18.8
   14.5       3.   23.7-27.4   3.    8.8-25.6   19.8
   15.0       3.   22.7-27.7   3.    8.8-26.9   0.5
   15.5       3.   22.2-27.6   2.    8.3-26.0   0.5
   16.0       2.   21.2-27.5   3.    8.3-27.2   0.5
   16.5       2.   22.7-27.8   3.    9.3-26.5   0.0
   17.0       2.   23.7-27.7   3.    8.3-27.9   1.0
   17.5       2.   22.7-27.2   3.    8.3-26.9   0.5
   18.0       2.   22.7-27.2   4.    8.8-27.0   1.0
```

3130	18.5	2.	22.7-27.2	3.	8.3-26.8	0.5
3140	19.0	3.	23.2-27.3	3.	8.3-27.6	0.5
3150	19.5	2.	22.7-23.1	3.	8.8-26.5	1.0
3160	20.0	2.	22.2-27.1	2.	7.3-27.	0.5
3170	20.5	2.	22.2-27.1	3.	23.2-26.9	1.0
3180	21.0	2.	23.2-27.4	2.	8.8-26.	0.0
3190	21.5	2.	22.2-27.9	2.	7.8-26.	0.0
3200	22.0	2.	22.7-28.0	2.	9.3-25.8	1.0
3210	22.5	3.	21.7-26.5	2.	8.3-26.2	1.5
3220	23.0	2.	21.8-27.1	2.	8.8-26.	1.0
3230	23.5	2.	21.3-27.4	2.	6.8-26.5	0.5
3240	24.0	2.	22.2-27.2	3.	6.8-26.1	0.0
3250	24.5	2.	21.7-26.5	3.	7.3-25.8	0.0
3260	25.0	2.	21.7-26.6	2.	5.3-26.	0.5
3270	25.5	5.	21.8-26.8	2.	6.8-26.	1.0
3280	26.0	3.	21.7-26.7	2.	6.3-25.	1.5
3290	26.5	3.	21.2-26.6	2.	6.3-25.	0.5
3300	27.0	3.	21.7-26.0	2.	6.3-25.5	0.0
3310	27.5	2.	21.7-26.9	2.	6.3-26.1	1.0
3320	28.0	3.	21.8-27.2	2.	6.3-25.6	0.0
3330	28.5	3.	21.3-27.2	2.	5.8-26.	0.0
3340	29.0	3.	21.8-26.1	2.	5.3-26.	1.0
3350	29.5	3.	21.2-26.7	2.	5.3-25.	0.0
3360	30.0	3.	21.3-26.3	2.	5.3-26.	0.0
3370	30.5	3.	19.8-25.2	2.	4.3-26.3	1.0
3380	31.0	3.	21.3-27.0	2.	4.8-26.	0.5
3390	31.5	3.	21.8-26.0	2.	4.8-25.	1.0
3400	32.0	3.	21.3-26.7	2.	4.8-26.6	0.0
3410	32.5	3.	21.3-27.1	2.	3.8-25.	0.5
3420	33.0	3.	21.3-26.3	2.	4.8-25.	1.0
3430	33.5	3.	21.3-27.0	2.	5.3-25.7	1.5
3440	34.0	3.	19.8-26.3	2.	4.8-25.	0.0
3450	34.5	3.	19.3-25.8	2.	4.3-24.	0.5
3460	35.0	3.	19.3-25.7	2.	4.3-24.7	0.5
3470	35.5	3.	21.3-25.5	2.	3.8-24.5	0.5
3480	36.0	2.	13.8-25.4	2.	4.8-24.	0.5
3490	36.5	2.	12.4-25.2	2.	4.8-23.9	1.0
3500	37.0	2.	13.3-25.0	2.	3.9-24.	1.0
3510	37.5	2.	13.3-25.4	2.	3.8-24.	0.5
3520	38.0	1.	-24.8	2.	4.3-23.	1.5
3530	38.5	1.	-24.8	2.	4.3-24.	1.0
3540	39.0	2.	13.3-25.8	2.	3.8-24.	0.5
3550	39.5	2.	13.3-24.3	2.	3.4-23.	0.5
3560	40.0	2.	11.9-24.0	2.	3.8-23.	1.5
3570	40.5	1.	-24.5	2.	3.8-23.7	1.0
3580	41.0	1.	-24.6	2.	3.4-23.6	1.0
3590	41.5	2.	12.9-24.6	2.	3.4-24.	0.5
3600	42.0	2.	13.3-24.4	2.	2.9-23.7	0.5
3610	42.5	2.	11.8-24.4	2.	3.4-23.7	2.0
3620	43.0	2.	13.4-24.5	2.	2.9-24.	0.5
3630	43.5	2.	11.9-24.1	2.	2.9-23.5	1.0
3640	44.0	2.	12.3-23.7	2.	2.8-22.8	0.5

3650	44.5	2.	12.4-24.1	2.	12.4-22.5	0.5
3660	45.0	2.	11.4-24.2	2.	11.9-23.2	0.5
3670	45.5	2.	11.9-23.5	2.	11.9-21.8	0.5
3680	46.0	2.	9.9-22.9	2.	11.9-21.3	0.5
3690	46.5	2.	11.4-23.3	2.	11.4-22.0	1.5
3700	47.0	2.	11.9-23.7	2.	11.4-21.1	0.5
3710	47.5	2.	11.4-23.0	2.	11.9-22.2	1.0
3720	48.0	2.	11.4-22.3	2.	11.4-21.9	0.0
3730	48.5	2.	12.4-22.6	2.	11.4-21.8	0.5
3740	49.0	2.	11.9-22.6	2.	10.9-21.1	1.0
3750	49.5	2.	11.4-22.9	2.	11.4-21.2	1.5
3760	50.0	2.	9.9-22.0	2.	10.4-21.7	1.0

SECTION X

TRAIN

```
      COMMON  KB,
     1 C, TV(10,181,10) , TTV(10,181,10) , BW(10,10,10) , BTW(10,10) ,
     2      W(10, 10,10) ,  TH(10,10) , AVDIST(10), X(12),
     3IID(10), ASP(10,181), LVEC(10), NWS(10), KWS(10,10), MODCNT, IQWS
      COMMON
     1  NC, ID, I, NPASS, NM, IMPRUV, IBEST, ITRAN, MODE, ICAT,
     2 NLV(10), NMODE(10), MBOD(10), NCORR
      COMMON/BLOCK1/ NWSB(10), KWSB(10,10)
       COMMON/BLOCK2/ INE(10), NE(10,10), INEMOD(10,10)
       COMMON/BLOCK3/ MODVC(10,181), MODVCB(10,181), KCNTT(10,10),
     1 AVMODE(10,10)
       COMMON/BLOCK4/ CC(10,10), IFORCE
       DIMENSION VOIDL(5), VOIDH(5), TGTID(12)
C
C
C
   10 CONTINUE
      WRITE (6,7500)
      WRITE (6, 1000)
 1000 FORMAT (1H , 22H OUTPUT FROM MAIN.... /)
      WRITE (6,7520)
C
C
C
C                          * * * * * * * * * *
C                          * * * * * * * * * *
      C = 4.0
 1003 FORMAT( 6F10.0 )
      READ  (5,1003) NC,NPROBS
 1003 FORMAT(1215)
      WRITE (6,1004) NC,NPROBS
 1004 FORMAT (1H , 5HNC = ,I2, 11H  NPROBS = ,I2)
      IF(NC.GT.0.AND.NC.LE.10.AND.NPROBS.GT.0.AND.NPROBS.LE.10)GO TO 11
      WRITE (6, 1005)
 1005 FORMAT(1H ,19HCHECK NC AND NPROBS)
      CALL EXIT
   11 CONTINUE
C                          * * * * * * * * * *
C                          * * * * * * * * * *
C
C
C
      WRITE (6,7501)
      NTT = 0
      CK = 4.0
      DO 40 I = 1, NC
      READ (5, 1001) THET1, THET2, DELTH
      WRITE (6, 3003) THET1, THET2, DELTH
 3003 FORMAT (1H ,8HTHET1 = ,F10.4,10H  THET2 = ,F10.4,10H  DELTH = ,
     1F10.4)
      NCMISS = 0
```

```
      ITGT = I
      THET11 = THET1
      THET21 = THET2
      DELTH1 = DELTH
      READ (5, 3004) TGTID, NPOL
 3004 FORMAT (12A4,7X,I2)
      WRITE (6, 3005) ITGT, TGTID, NPOL
 3005 FORMAT (//15 ,13HCATEGORY NO. ,I3,3H. ,12A4,29H NO. POLARIZATIONS
     1 AVAILABLE ,I3)
      READ (5, 3006) DTHET
 3006 FORMAT (20X,F10.0)
      WRITE (6, 3007) DTHET
 3007 FORMAT (1H ,17HASPECT INCREMENT ,F10.5,8H DEGREES)
      IF (DELTH1.GE.DTHET) GO TO 500
      DELTH1 = DTHET
  500 CONTINUE
  502 CONTINUE
      DO 504 L = 1, NPOL
      READ (5, 3010) NVOID
 3010 FORMAT (32X,I4)
      IF (NVOID.EQ.0) GO TO 504
      READ (5, 3011) (VOIDL(K),VOIDH(K) , K = 1, NVOID)
 3011 FORMAT( 10F8.0 )
  504 CONTINUE
      IF (NVOID.EQ.0) GO TO 600
      WRITE (6, 3050)
 3050 FORMAT (1H ,42HNON. VOIDS AND THEIR LOWER AND UPPER LIMITS)
      WRITE (6, 3011) NVOID, (VOIDL(J),VOIDH(J), J = 1,NVOID)
 3011 FORMAT(1X,I4,3X,10F6.1 )
      DO 506 L = 1, NVOID
      IF (THET1.GE.VOIDL(L).AND.THET1.LT.VOIDH(L)) THET11=VOIDH(L)
      IF (THET2.GT.VOIDL(L).AND.THET2.LE.VOIDH(L)) THET21=VOIDL(L)
      IF (THET11.LT.THET21) GO TO 506
 3052 FORMAT (1H ,66HASPECT SECTOR CHOSEN FALLS WITHIN A VOID IN THE DAT
     1A FOR CATEGORY , I3)
      CALL EXIT
  506 CONTINUE
      DO 508 L = 1, NVOID
      VOYD = 0.5*(VOIDL(L) + VOIDH(L))
      IF (VOYD.GT.THET11.AND.VOYD.LT.THET21) NCMISS = FLOAT(NCMISS) +
     1VOYD/DTHET - 1.0
  508 CONTINUE
  600 NCDS = (THET21 - THET11)/DTHET + 1.0 - FLOAT(NCMISS)
      ISKP =    DELTH/DTHET + 0.4
      ICDS = 0
      NLV(ITGT) = 1
      WRITE (6, 6000) I
 6000 FORMAT (/3X,31HTRAINING VECTORS FOR CATEGORY ,I2)
C
       TTV(ITGT,1,5) = 1.0
       TTV(ITGT,1,6) = 0.5
  589 CONTINUE
```

```
      JJ = NLV(ITGT)
  520 READ  (5,5003) ASP(ITGT,JJ),(TTV(ITGT,JJ,J),J=1,6)
      WRITE (6,6001) ASP(ITGT,JJ),(TTV(ITGT,JJ,J),J=1,6)
 5003 FORMAT( F6.2,4X,7F5.0 )
 6001 FORMAT(1X,10F8.2 )
C
  524 ICDS = ICDS + 1
C
  525 NLV(ITGT) = NLV(ITGT) + 1
      IF (NCDS.LE.ICDS) GO TO 530
      IF (ISKP.EQ.0) GO TO 509
      IBDM = NCDS - (ICDS + ISKP)
      IF (IBDM.LT.0) GO TO 527
      DO 526 LL = 1,ISKP
      READ (5, 4000)
 4000 FORMAT (72X)
  526 CONTINUE
      ICDS = ICDS + ISKP
      IF (NCDS.LE.ICDS) GO TO 530
      GO TO 509
  527 LLL = NCDS - ICDS
      DO 528 LL = 1,LLL
      READ (5, 4000)
  528 CONTINUE
  530 NLV(ITGT) = NLV(ITGT) - 1
      NTT = NTT + NLV(ITGT)
   40 CONTINUE
      NSIG = NTT
      IPROB = 0
  700 IPROB = IPROB + 1
      NPASS = 1
      IBEST = 0
C
C
      READ (5,1003) NPDES, (IID(J21),J21=1,5)
      ID = 0
      DO 701 J21=1,5
      IF( IID(J21) .EQ. 0 ) GO TO 701
      ID = ID + 1
      LVEC(ID) = J21
  701 CONTINUE
C
      WRITE (6,7000)IPROB
 7000 FORMAT (////1 X,33HDISCRIMINANTS FOR PROBLEM NUMBER ,I2)
C
      DO 704 J21=1,NC
      WRITE (6,7001) J21
 7001 FORMAT (/14 ,9HCATEGORY ,I2)
      J20 = NLV(J21)
      DO 703 J22=1,J20
      MODVC(J21,J22) = 1
      IF( NPDES .EQ. 2 ) GO TO 706
```

```
      DO 702 J23=1,ID
      JJVEC = LVEC(J23)
      TV(J21,J22,J23) = TTV(J21,J22,JJVEC)
  702 CONTINUE
      GO TO 815
  706 CONTINUE
      DO 710 J23=1,ID
      LLVEC = LVEC(J23)
      GO TO (801,802,803,804,805),LLVEC
  801 TV(J21,J22,J23) = AMAX1(TTV(J21,J22,1),TTV(J21,J22,4))
      GO TO 710
  802 TV(J21,J22,J23) = AMAX1(TTV(J21,J22,2),TTV(J21,J22,5))
      GO TO 710
  803 TV(J21,J22,J23) = AMAX1(TTV(J21,J22,3),TTV(J21,J22,6))
      GO TO 710
  804 TV(J21,J22,J23) = AMIN1(TTV(J21,J22,3),TTV(J21,J22,6))
      GO TO 710
  805 S1 = 10.**(TTV(J21,J22,3)/20.)
      S2 = 10.**(TTV(J21,J22,6)/20.)
      TV(J21,J22,J23) = ABS(S1-S2)/(S1+S2)
  710 CONTINUE
  815 WRITE (6,6001) ASP(J21,J22), (TV(J21,J22,J),J=1,ID)
  703 CONTINUE
  704 CONTINUE
C
C
C
C
      DO 41 I = 1, NC
      NWS(I) = 0
      NWSB(I) = 0
   41 CONTINUE
   15 IMD = 0
      DO 740 I=1,NC
      MODPAS = 0
      IF( NPASS .GT. 1 ) GO TO 730
      NMODE(I) = 1
      CALL UNIMOD
      IF( NPASS .EQ. 1 ) GO TO 740
  730 CONTINUE
      IF( INE(I) .EQ. 0 ) GO TO 740
      MODCNT = 0
  735 CALL NUMOD
      IF( NM .EQ. 0 ) GO TO 740
      IMD = 1
      MODCNT = MODCNT + 1
      CALL TRAN
      IF( MODCNT .GE. 3 ) GO TO 740
      IF( IFORCE .EQ. 1 ) GO TO 740
      MODPAS = MODPAS + 1
      IF( MODPAS .GE. 20 ) GO TO 740
      GO TO 735
```

```
  780 CONTINUE
C
      IF (NPASS.EQ.1) GO TO 45
      IF (IMD.EQ.0) GO TO 50
   45 CONTINUE
      WRITE (6,7500)
 7500 FORMAT (1/1H ,82H**********************************************
     1**********)
      WRITE (6,7510)
 7510 FORMAT (30X,3 H OUTPUT FROM SUBROUTINE DISTNC)
      WRITE (6,7520)
 7520 FORMAT (1H ,82H**********************************************
     1**********)
      DO 46  I =1,NC
      IF( NPASS .EQ. 1 ) GO TO 200
      IF( INE(I) .NE. 0) GO TO 200
      WRITE (6,8030) I
 8030 FORMAT (/1H ,25HINFORMATION FOR CATEGORY ,I3,15H IS SAME AS FOR,
     1/1H , 13HPREVIOUS PASS)
      GO TO 46
  200 CONTINUE
      CALL DISTNC
      NMD = NMODE(I)
      IF( NPASS .EQ. 1 ) GO TO 46
      WRITE (6,7530)
 7530 FORMAT (/1H , 32HNO. OF TRAINING VECTORS PER MODE)
      WRITE (6,7535)( L, KCNTT(I,L),L=1,NMD )
 7535 FORMAT(1X,I3,10X,I6 )
   46 CONTINUE
      WRITE (6,7530)
      WRITE (6,7540)
 7540 FORMAT (30X, 27HSTABALIZED OUTPUT FROM TRAN)
      WRITE (6,7520)
      DO 48  I =1,NC
      WRITE (6,7545) I
 7545 FORMAT (/1H , 13HCATEGORY NO. ,I3/)
      IF( NPASS .EQ. 1 ) GO TO 210
      IF( INE(I) .NE. 0) GO TO 210
      WRITE (6,8040)
 8040 FORMAT (/1H ,44HINFORMATION FOR THIS CATEGORY IS SAME AS FOR,
     1/1H , 13HPREVIOUS PASS)
      GO TO 48
  210 CONTINUE
      NMD = NMODE(I)
      DO 47 L=1,NMD
      WRITE (6,7550) L
 7550 FORMAT (1H , 9HMODE NO. , I3)
      WRITE (6,7555)( W(L,I,J), J=1,ID )
 7555 FORMAT(10X,10(4X,F8.3) )
      WRITE (6,1017) TH(L,I)
   47 CONTINUE
   48 CONTINUE
```

```
      WRITE (6,7500)
      WRITE (6,7565)
 7565 FORMAT (3X, 28H OUTPUT FROM SUBROUTINE EVAL)
      WRITE (6,7520)
      DO 52 I=1,NC
      INE(I)  = 0
      NMD = NMODE(I)
      DO 53 K1=1,NMD
   53 INEMOD(I,K1) = 0
      DO 51 J=1,NC
      NE(I,J) = 0
   51 CONTINUE
   52 CONTINUE
      CALL EVAL
      IF (NCORR.EQ.NSIG) GO TO 65
      IF (IMPROV.EQ.1) GO TO 55
   50 NPASS = NPASS + 1
      GO TO 60
   55 NPASS = 2
   60 IF( NPASS .GT. 4 ) GO TO 70
      WRONG  =  NSIG - NCORR
      DO 61 I=1,NC
      NMD = NMODE(I)
      DO 62 J=1,NMD
      EMOD = INEMOD(I,J)
      CC(I,J) = CK*(1. - EMOD/WRONG )
      IF( CC(I,J) .LT. 3. ) CC(I,J) = 3.
   62 CONTINUE
   61 CONTINUE
      GO TO 15
   65 WRITE (6, 1018)
 1018 FORMAT (1H0, 43H **** ALL VECTORS CLASSIFIED CORRECTLY ****)
      WRITE (6,7500)
   70 WRITE (6, 1013)
      WRITE (6,7520)
      WRITE (6,7520)
      WRITE (6,7520)
      WRITE (6, 1013) IBEST
 1013 FORMAT (1H0, 38H BEST PERFORMANCE ON TRAINING SET,...? ,I10/)
      DO 90 I = 1, NC
      NPN = NWSB(I)
      NEVCR = NLV(I)
      NMD = MBOD(I)
      WRITE (6, 1014) I
 1014 FORMAT (/35X, 43H FINAL WEIGHTS AND THRESHOLDS FOR CATEGORY ,I3)
      WRITE (6, 2000) NWSB(I)
 2000 FORMAT (35X, 32H (TOTAL NUMBER OF WILD SHOTS IS ,I3,2H.) )
      WRITE (6,8000)
 8000 FORMAT (35X, 37H**********$**********$**********$)
      DO 80 L = 1, NMD
      WRITE (6, 1015) L
 1015 FORMAT (1H0, 13H MODE NUMBER , I4)
```

```
      WRITE (6, 1016) (BW(L,I,J), J = 1,ID)
 1016 FORMAT (24X, 10(2X,F8.3))
      WRITE (6, 1017) BTH(L,I)
 1017 FORMAT (26X, 13H THRESHOLD = , F10.3)
      WRITE (6,8010)
 8010 FORMAT (/ 16X, 27H ASPECT  DISCRIMINANTS...,)
      DO 79 K=1,NEVCR
      IF( MODVCB(I,K) .NE. L ) GO TO 79
      IF (NWSB(I).EQ.0) GO TO 76
      DO 74 ICK = 1, NPN
      IF (K.NE.KWS3(I,ICK)) GO TO 74
      WRITE (6, 2001) ASP(I,K), (TV(I,K,JJ), JJ = 1, ID)
 2001 FORMAT (1H , 16H***WILD SHOT*** ,F5.1,2X,10(2X,F8.3))
      GOTO 79
   74 CONTINUE
   76 CONTINUE
      WRITE (6,8020) ASP(I,K), (TV(I,K,JJ),JJ=1,ID)
 8020 FORMAT( 17X,F5.1,2X,10(2X,F8.3) )
   79 CONTINUE
   80 CONTINUE
   90 CONTINUE
C
C
      IF( IPROB .LT. NPROBS ) GO TO 700
      GO TO 10
      END
      SUBROUTINE UNIMOD
C
      COMMON  KB,
     1 C, TV(10,181,10) , TTV(10,181,10) , BW(10,10,10) , BTH(10,10) ,
     2      W(10, 1),10) ,  TH(10,10) , AVDIST(10), X(12),
     3IID(10), ASP(10,181), LVEC(10), NWS(10), KWS(10,10), MODCNT, IGWS RR5U0
      COMMON
     1  NC, ID, I, NPASS, NM, IMPROV, IBEST, ITRAN, MODE, ICAT,
     2 NLV(10), NMODE(10), MBOD(10), NCORR
C
C
      DO 1) J = 1, ID
      W(1,I,J) = 0.0
   10 CONTINUE
      TH(1,I) = 0.0
      NVECR = NLV(I)
      DO 30 K = 1, NVECR
      DO 20 J = 1, ID
      W(1,I,J) = W(1,I,J) + TV(I,K,J)
   20 CONTINUE
   30 CONTINUE
      DO 40 J = 1, ID
      W(1,I,J) = W(1,I,J)/FLOAT(NVECR)
      TH(1,I) = TH(1,I) + W(1,I,J)*W(1,I,J)
   40 CONTINUE
      TH(1,I) = TH(1,I)/2.
```

```
C
C                    * * * * * * * * * *
      RETURN
      END
      SUBROUTINE NJMOD
C
      COMMON  KB,
     1 C, TV(10,181,10) , TTV(10,181,10) , BW(10,10,10) , BTH(10,10) ,
     2      W(10, 10,10) ,  TH(10,10) , AVDIST(10), X(12),
     3 ID(10), ASP(10,181), LVEC(10), NWS(10), KWS(10,10), MODCNT, IGWS RR5NO
      COMMON
     1  NC, ID, I, NPASS, NM, IMPRUV, IBEST, ITRAN, MODE, ICAT,
     2 NLV(10), NMODE(10), MBOD(10), NCORR
      COMMON/BLOCK2/ INE(10), NE(10,10), INEMOD(10,10)
      COMMON/BLOCK3/ MODVC(10,181), MODVCB(10,181), KCNTT(10,10),
     1 AVMODE(10,10)
      COMMON/BLOCK4/ CC(10,10), IFORCE
      DIMENSION AVE(10)
C
C
      NFORCE = 0
      IFORCE = 0
      NMD = NMODE(I)
      DO 4 L=1,NMD
      AVE(L) = CC(I,L)*AVMODE(I,L)
      IF( AVE(L) .LT. .001 ) AVE(L) = .001
    4 CONTINUE
    1 CONTINUE
      ITRAN = 1
      NM = 0
      IF (NMODE(I).GE.10) GO TO 50
      NVECR = NLV(I)
      DO 30 K = 1, NVECR
      IF (NWS(I).EQ.0) GO TO 6
      NNN = NWS(I)
      IF (NNN.GT.10) NNN = 10
      DO 5 N1 = 1, NNN
      IF (K.EQ.KWS(I,N1)) GO TO 30
    5 CONTINUE
    6 CONTINUE
      DO 10 J = 1, ID
      X(J) = TV(I,K,J)
   10 CONTINUE
      CALL DECIDE
      IF( INEMOD(I,MODE) .EQ. 0 ) GO TO 30
      DIS = 0.0
      DO 20 J = 1, ID
      DIS = DIS + (W(MODE,I,J)-TV(I,K,J))*(W(MODE,I,J)-TV(I,K,J))
   20 CONTINUE
      DIS = SQRT(DIS)
      IF( DIS .LE. AVE(MODE) ) GO TO 30
      KB = K
```

```
      GO TO 55
   80 CONTINUE
      GO TO 50
   85 NM = 1
      NMODE(I) = NMODE(I) + 1
      NMD = NMODE(I)
      CC(I,NMD) = CC(I,MODE)
      AVMODE(I,NMD) = AVE(MODE)
      INEMOD(I,NMD) = INEMOD(I,MODE)
      TH(NMD,I) = 0.0
      DO 40 J = 1, ID
      W(NMD,I,J) = TV(1,KB,J)
      TH(NMD,I) = TH(NMD,I) + W(NMD,I,J)*W(NMD,I,J)
   40 CONTINUE
      TH(NMD,I) = -TH(NMD,I)/2.
   50 CONTINUE
      IF( NM .EQ. 1 ) GO TO 70
      IF( MODCNT .GT. 0 ) GO TO 70
      NFORCE = NFORCE + 1
      IF( NFORCE .GE. 10 ) GO TO 70
      IFORCE = 1
      DO 60 L=1,NMD
   60 AVE(L) = 0.9*AVE(L)
      GO TO 1
   70 CONTINUE
      RETURN
      END
      SUBROUTINE DISTNC
C
      COMMON  KB,
     1 C, TV(10,181,10) , TTV(10,181,10) , BW(10,10,10) , BTH(10,10) ,
     2      W(10, 10,10) ,  TH(10,10) , AVDIST(10), X(12),
     3 ID(10), ASP(10,181), LVEC(10), NWS(10), KWS(10,10), MODCNT, IGWS RR5D0
      COMMON
     1  NC, ID, I, NPASS, NM, IMPRUV, IBEST, ITRAN, MODE, ICAT,
     2 NLV(10), NMODE(10), MBOD(10), NCORR
      COMMON/BLOCK3/ MODVC(10,181), MODVCB(10,181), KCNTT(10,10),
     1 AVMODE(10,10)
      DIMENSION  ICNT(10)
C
C
      ITRAN = 1
      AVDIST(I) = 0.0
      NMD = NMODE(I)
      DO 10 L = 1, NMD
      AVMODE(I,L) = 0.
      ICNT(L) = 0
      KCNTT(I,L) = 0
   10 CONTINUE
      IF( NPASS .GT. 1 ) WRITE(6,1004)
 1004 FORMAT (/14 , 38HCAT. NO.   TRAIN. VEC. NO.     MODE NO.)
      NVECR = NLV(I)
```

```
      DO 40 K = 1, NVECR
      DO 20 J = 1, ID
      X(J) = TV(I,K,J)
   20 CONTINUE
      CALL DECIDE
      IF( NPASS .GT. 1 ) WRITE(6,1003) I,K,MODE
 1003 FORMAT (1H ,3X,I3,12X,I3,12X,I3)
      ICNT(MODE) = ICNT(MODE) + 1
      MODVC(I,K) = MODE
      DIS = 0.0
      DO 30 J = 1, ID
      DIS = DIS + (W(MODE,I,J)-TV(I,K,J))*(W(MODE,I,J)-TV(I,K,J))
   30 CONTINUE
      AVMODE(I,MODE) = AVMODE(I,MODE) + SQRT(DIS)
   40 CONTINUE
      DO 50 L = 1, NMD
      AVMODE(I,L) = AVMODE(I,L)/FLOAT(ICNT(L))
      KCNTT(I,L) = ICNT(L)
      WRITE (6,1001) L,AVMODE(I,L)
 1001 FORMAT (1H , 8HMODE NO.,I3, 32H MEAN DISTANCE TO MODE VECTOR = ,
     1F10.3)
      AVDIST(I) = AVDIST(I) + AVMODE(I,L)
   50 CONTINUE
      AVDIST(I) = AVDIST(I)/FLOAT(NMD)
      WRITE (6, 1002) I, NMD, AVDIST(I)
 1002 FORMAT (1H , 9HCATEGORY(,I2, 15H)   NO. MODES =,I3, 27H   OVERALL RMSD
     1MEAN DISTANCE = ,F8.3/)
      RETURN
      END
      SUBROUTINE DECIDE
C
      COMMON  KB,
     1 C, TV(10,181,10) , TTV(10,181,10) , BW(10,10,10) , BTH(10,10) ,
     2      W(10, 10,10) ,  TH(10,10) , AVDIST(10), X(12),
     3IID(10), ASP(10,181), LVEC(10), NWS(10), KWS(10,10), MODCNT, IGWS RMSC
      COMMON
     1  NC, ID, I, NPASS, NM, IMPRUV, IBEST, ITRAN, MODE, ICAT,
     2 NLV(10), NMODE(10), MBOD(10), NERR
      DIMENSION
     1G(10,10)
C
C
      IF (ITRAN.EQ.0) GO TO 10
      II = I
      IUP = I
      GO TO 20
   10 II = 1
      IUP = NC
   20 DO 40 I1 = II, IUP
      NMD = NMODE(I1)
      DO 30 L = 1, NMD
      G(L,I1) = 0.0
```

```
   80 CONTINUE
   60 CONTINUE
      DO 90 I1 = II, IUP
      NMD = NMODE(I1)
      DO 70 L = 1, NMD
      DO 50 J = 1, ID
      G(L,I1) = G(L,I1) + X(J)*W(L,I1,J)
   50 CONTINUE
      G(L,I1) = G(L,I1) + TH(L,I1)
      IF (L.EQ.1) GO TO 60
      IF (G(L,I1).LT.GMMAX) GO TO 70
   60 LODE = L
      GMMAX = G(L,I1)
   70 CONTINUE
      IF (I1.EQ.1.OR.ITRAN.EQ.1) GO TO 80
      IF (GMMAX.LT.GMAX) GO TO 90
   80 ICAT = I1
      MODE = LODE
      GMAX = GMMAX
   90 CONTINUE
      RETURN
      END
      SUBROUTINE TRAN
C
      COMMON  KB,
     1 C. TV(10,181,10) , TTV(10,181,10) , BW(10,10,10) , BTH(10,10) ,
     2      W(10, 10,10) ,  TH(10,10) , AVDIST(10), X(12),
     3IID(10), ASP(10,181), LVEC(10), NWS(10), KWS(10,10), MODCNT, IGWS RRST
      COMMON
     1  NC, ID, I, NPASS, NM, IMPRUV, IBEST, ITRAN, MODE, ICAT,
     2 NLV(10), VMODE(10), MMOD(10), NCORR
      COMMON/BLOCK2/ INE(10), NE(10,10), INEMOD(10,10)
      COMMON/BLOCK3/ MODVC(10,181), MODVCB(10,181), KCNTT(10,10),
     1 AVMODE(10,10)
      COMMON/BLOCK4/ CC(10,10), IFORCE
      DIMENSION
     1KCNT(10), JCNT(10), LWS(10)
C
C
      KILPAS = 0
      KILL = 0
      IGWS = 0
      ITRAN = 1
      NMD = NMODE(I)
    4 KPAS = 1
   10 DO 20 L = 1, NMD
      KCNT(L) = 1
   20 CONTINUE
      NVECR = NLV(I)
      DO 50 K = 1, NVECR
      IF (NWS(I).EQ.0) GO TO 6
      NVA = NWS(I)
```

```
      IF (NVA.GT.10) NVA = 10
      DO 5 N1 = 1, NVA
      IF (K.EQ.KWS(I,N1)) GO TO 50
    5 CONTINUE
    6 CONTINUE
      DO 30 J = 1, ID
      X(J) = TV(I,K,J)
   30 CONTINUE
      CALL DECIDE
      KCNT(MODE) = KCNT(MODE) + 1
      THR = 0.0
      IF( KCNT(MODE) .GT. 2 ) GO TO 31
      LWS(MODE) = K
   31 CONTINUE
      DO 40 J = 1, ID
      W(MODE,I,J)=(FLOAT(KCNT(MODE)-1)/FLOAT(KCNT(MODE)))*W(MODE,I,J)
     1+TV(I,K,J)/(FLOAT(KCNT(MODE)))
      THR = THR + W(MODE,I,J)*W(MODE,I,J)
   40 CONTINUE
      TH(MODE,I) = -THR/2.
   50 CONTINUE
      DO 51 JJ1=1,NMD
      KCNT(JJ1) = KCNT(JJ1) - 1
   51 CONTINUE
      INCRS = 0
      DO 70 L = 1, NMD
      IF (KPAS.EQ.1) GO TO 60
      IF (KCNT(L).LE.JCNT(L)) GO TO 70
   60 JCNT(L) = KCNT(L)
      INCRS = 1
   70 CONTINUE
      IF (INCRS.EQ.0) GO TO 80
      KPAS = KPAS + 1
      IF (KPAS.LE.10) GO TO 10
   80 CONTINUE
      KX1 = 0
      DO 90 L = 1, NMD
      IF (KCNT(L).GT.1) GO TO 85
      IF( KCNT(L) .LT. 1 ) KILL = 1
      NVA = NWS(I)
      IF( NVA .EQ. 0 ) GO TO 107
      DO 105 N1 = 1, NVA
      IF( KILL .EQ. 0 ) GO TO 106
      IF( KB .EQ. KWS(I,N1) ) GO TO 81
      GO TO 105
  106 CONTINUE
      IF (LWS(L).EQ.KWS(I,N1)) GO TO 81
  105 CONTINUE
  107 CONTINUE
      NWS(I) = NWS(I) + 1
      IF (NWS(I).GT.10) GO TO 82
      IF( KILL .EQ. 0 ) GO TO 101
```

```
      MNO = NWS(I)
      KWS(I,MNO) = KB
      WRITE (6,1005) KB, I
 1005 FORMAT (1H , 13HKILLED VECTOR,I3, 12H IN CATEGORY,I3)
      GO TO 81
  881 CONTINUE
      MNO = NWS(I)
      KWS(I,MNO) = LWS(L)
   81 CONTINUE
      NMODE(I) = NMODE(I) + 1
      IF (NMODE(I).LT.1) NMODE(I) = 1
   82 IGWS = 1
      GO TO 90
   85 KX1 = KX1 + 1
      DO 86 J = 1, ID
      W(KX1,I,J) = W(L,I,J)
   86 CONTINUE
      TH(KX1,I) = TH(L,I)
      INEMOD(I,KX1) = INEMOD(I,L)
      AVMODE(I,KX1) = AVMODE(I,L)
          CC(I,KX1) =     CC(I,L)
   90 CONTINUE
      IF( KILL .EQ. 0 ) GO TO 92
      KILL = 0
      KILPAS = KILPAS + 1
      IF ( KILPAS .GT. 1 ) GO TO 92
      GO TO 4
   92 CONTINUE
      IF (IGWS.EQ.0) GO TO 91
      IF (NWS(I).GT.10) GO TO 91
      MODCNT = MODCNT + 1
   91 CONTINUE
      RETURN
      END
      SUBROUTINE EVAL
C
      COMMON  KB,
     1 C, TV(10,181,10) , TTV(10,181,10) , BW(10,10,10) , BTH(10,10) ,
     2     W(10, 10,10) ,  TH(10,10) , AVDIST(10), X(12),
     3IID(10), ASP(10,181), LVEC(10), NWS(10), KWS(10,10), MODCNT, IGWS RR5E0
      COMMON
     1  NC, ID, I, NPASS, NM, IMPRUV, IBEST, ITRAN, MODE, ICAT,
     2 NLV(10), NMODE(10), MBOD(10), NCORR
      COMMON/BLOCK1/ NWSB(10), KWSB(10,10)
      COMMON/BLOCK2/ INE(10), NE(10,10), INEMOD(10,10)
      COMMON/BLOCK3/ MODVC(10,181), MODVCB(10,181), KCNTT(10,10),
     1 AVMODE(10,10)
      DIMENSION JI(10)
C
C
      ITRAN = 0
      IMPRUV = 0
```

```
      NCORR = 0
      WRITE (6, 1001)
 1001 FORMAT (1H , 54HTRUE CAT?   VECTOR NO.   TRUE MODE   MACH. CAT.
     1MODE/)
      DO 40 I = 1, NC
      JI(I) = I
      NVECR = NLV(I)
      DO 30 K = 1, NVECR
      DO 10 J = 1, ID
      X(J) = TV(I,K,J)
   10 CONTINUE
      CALL DECIDE
      IF (ICAT.NE.I) GO TO 20
      NCORR = NCORR + 1
      GO TO 30
   20 WRITE (6,1002) I, K, MODVC(I,K), ICAT, MODE
 1002 FORMAT( 5X,I2,10X,I3,11X,I2,11X,I2,7X,I2 )
      NE(I,ICAT) = NE(I,ICAT) + 1
      MJJ= MODVC(I,K)
      INEMOD(I,MJJ) = INEMOD(I,MJJ) + 1
   30 CONTINUE
   40 CONTINUE
      DO 42 JJJ = 1,NC
      DO 41 JJ=1,NC
      INE(JJJ) = INE(JJJ) + NE(JJJ,JJ)
   41 CONTINUE
   42 CONTINUE
      WRITE (6, 1003) NCORR
 1003 FORMAT (1H0, 34H NO. CORRECT CLASSIFICATIONS,...., I6/)
      IF (NCORR.LE.IBEST) GO TO 90
      IMPRUV = 1
   50 IBEST = NCORR
      DO 80 I = 1, NC
      NWSB(I) = NWS(I)
      IF (NWSB(I).EQ.0) GO TO 55
      NNN = NWSB(I)
      DO 54 N1 = 1, NNN
      KWSB(I,N1) = KWS(I,N1)
   54 CONTINUE
   55 CONTINUE
      NVECR = NLV(I)
      DO 61 KK=1,NVECR
   61 MODVCB(I,KK) = MODVC(I,KK)
      MBOD(I) = NMODE(I)
      NMD = MBOD(I)
      DO 70 L = 1, NMD
      DO 60 J = 1, ID
      BW(L,I,J) = W(L,I,J)
   60 CONTINUE
      BTH(L,I) = TH(L,I)
   70 CONTINUE
   80 CONTINUE
```

```
   90 CONTINUE
      WRITE (6,1004)
 1004 FORMAT(/15X,12HERROR MATRIX)
      WRITE (6,1005)( JI(IJ),IJ=1,NC )
 1005 FORMAT( 5X,10(1X,I2,2X) )
      DO 100 I=1,NC
      WRITE (6,1006) I,(NE(I,II),II=1,NC)
 1006 FORMAT (2X,I2,1X,10(I4,1X))
  100 CONTINUE
      RETURN
      END
    3    3
#000        50.0        170
     MODEL    A1 / 59                                          9.00     2     15
  436      -55.5          147          0.5          0.49
VERT/VERT       101      0.0     50.0    0
HORIZ/HORIZ     101      0.0     50.0    0
   0.0        5.0 52.7-24.1   4.0 52.2-23.8 32.5
   0.5        6.0 52.7-25.7   6.0 53.7-23.8 53.2
   1.0        5.0 53.2-24.9   6.0 52.7-24.9 52.7
   1.5        6.0 53.2-25.1   6.0 52.7-25.2  0.5
   2.0        5.0 53.2-25.4   6.0 52.2-25.5  0.5
   2.5        6.0 53.7-25.1   6.0 52.2-25.5  1.0
   3.0        4.0 52.8-25.6   5.0 52.7-26.2  1.0
   3.5        5.0 52.7-26.1   5.0 52.3-26.4 51.3
   4.0        4.0 52.7-27.0   5.0 52.3-24.6 50.8
   4.5        4.0 54.2-26.7   5.0 51.8-24.9 52.8
   5.0        4.0 54.7-26.4   5.0 52.7-25.7 52.7
   5.5        5.0 54.2-26.4   6.0 52.3-26.3  0.5
   6.0        4.0 52.7-26.6   5.0 51.8-26.6  0.5
   6.5        3.0 53.7-26.8   6.0 52.3-26.4  0.5
   7.0        3.0 52.7-25.8   6.0 51.8-26.4  0.5
   7.5        3.0 53.2-26.5   6.0 51.8-25.9  0.5
   8.0        2.0 18.2-26.3   6.0 52.8-26.3 52.3
   8.5        3.0 52.8-25.9   4.0 51.8-25.2  1.0
   9.0        3.0 52.3-25.9   5.0 50.8-25.1  0.0
   9.5        2.0 52.8-26.1   5.0 52.3-25.4  0.0
  10.0        2.0 51.8-25.3   6.0 51.3-25.8  0.0
  10.5        3.0 54.2-25.1   5.0 51.3-25.3  0.0
  11.0        3.0 53.7-26.2   5.0 51.3-25.2  0.0
  11.5        3.0 55.7-26.0   5.0 50.8-24.4  0.5
  12.0        3.0 54.7-25.8   5.0 51.3-24.5  0.5
  12.5        3.0 51.8-24.8   6.0 50.8-25.3  1.0
  13.0        4.0 51.3-25.7   6.0 50.8-24.7  1.5
  13.5        3.0 51.3-26.1   7.0 50.8-24.8  1.0
  14.0        3.0 50.8-25.9   7.0 50.3-25.6  0.5
  14.5        3.0 50.3-25.5   7.0 50.8-25.0  1.0
  15.0        3.0 50.8-26.1   6.0 50.8-25.8  0.0
  15.5        3.0 50.3-25.8   5.0 51.3-24.8  0.0
  16.0        5.0 48.8-27.0   6.0 49.3-25.4  0.5
  16.5        3.0 50.3-26.5   5.0 50.3-26.2  0.5
  17.0        3.0 49.8-25.6   5.0 46.4-25.9  1.0
```

17.5	4.0	49.8-26.6	6.0	49.8-25.9	0,5
18.0	3.0	49.3-26.0	6.0	49.8-26.3	0,5
18.5	3.0	48.8-26.3	6.0	49.3-25.6	0,0
19.0	3.0	48.3-25.9	5.0	44.9-26.2	1,0
19.5	3.0	50.8-25.5	6.0	48.8-26.0	1,0
20.0	3.0	49.3-25.1	3.0	45.4-25.2	0,5
20.5	2.0	51.8-25.5	4.0	48.8-25.6	0,0
21.0	2.0	52.2-25.2	4.0	48.8-24.9	1,5
21.5	2.0	49.3-24.5	4.0	48.8-24.4	0,0
22.0	3.0	47.8-25.4	4.0	48.3-24.8	0,0
22.5	3.0	47.3-24.3	5.0	47.8-24.7	0,5
23.0	3.0	47.8-24.9	5.0	47.3-24.9	1,0
23.5	3.0	46.8-24.9	4.0	46.8-24.6	0,5
24.0	3.0	46.3-25.0	5.0	46.8-24.8	1,5
24.5	3.0	47.3-26.1	4.0	46.8-24.7	1,0
25.0	3.0	46.8-25.2	4.0	46.8-25.0	0,5
25.5	2.0	46.8-25.9	4.0	46.3-24.1	0,5
26.0	2.0	47.8-25.1	4.0	46.8-23.7	1,0
26.5	2.0	45.3-24.8	4.0	45.8-24.6	1,0
27.0	2.0	46.3-24.6	4.0	45.8-24.3	0,0
27.5	2.0	45.3-24.5	4.0	44.8-24.4	0,0
28.0	4.0	49.8-25.0	4.0	45.3-24.5	0,5
28.5	3.0	44.8-26.2	4.0	44.8-24.6	0,5
29.0	2.0	46.8-26.0	5.0	45.3-25.2	1,0
29.5	2.0	45.3-25.7	4.0	44.8-25.1	1,0
30.0	2.0	45.3-25.7	4.0	44.4-25.3	0,0
30.5	2.0	43.8-24.3	4.0	43.4-24.9	0,5
31.0	3.0	44.3-24.9	4.0	42.9-25.4	0,5
31.5	3.0	44.8-25.0	4.0	43.9-25.4	0,0
32.0	3.0	43.9-25.9	5.0	43.4-25.6	0,5
32.5	2.0	43.4-25.1	4.0	43.4-25.1	0,5
33.0	2.0	43.4-24.9	5.0	42.9-24.4	0,5
33.5	3.0	46.3-24.2	4.0	42.4-23.7	0,5
34.0	2.0	43.9-24.4	4.0	41.4-23.3	1,0
34.5	2.0	43.4-24.5	5.0	41.9-23.7	0,5
35.0	2.0	42.9-24.8	5.0	41.4-24.0	1,0
35.5	2.0	41.4-25.7	4.0	41.9-23.6	1,0
36.0	2.0	42.4-24.4	4.0	41.9-23.5	1,5
36.5	2.0	41.9-24.4	4.0	41.0-23.2	0,9
37.0	2.0	40.9-23.8	4.0	40.0-23.4	0,9
37.5	2.0	40.4-23.6	4.0	40.4-23.6	0,5
38.0	3.0	40.4-24.8	4.0	40.9-24.1	0,0
38.5	3.0	39.9-24.7	3.0	40.4-23.8	0,0
39.0	2.0	39.0-24.6	3.0	40.4-23.3	1,4
39.5	2.0	38.5-24.8	3.0	39.9-23.1	1,9
40.0	2.0	38.5-23.8	4.0	38.9-23.5	1,4
40.5	2.0	39.4-24.4	4.0	38.4-23.8	0,0
41.0	2.0	38. -23.9	4.0	38.4-23.5	1,9
41.5	3.0	38.0-24.2	4.0	38.0-23.0	0,5
42.0	3.0	37.5-24.0	4.0	37.0-23.5	0,5
42.5	3.0	37.4-24.0	4.0	37.5-23.9	0,9
43.0	3.0	37. -23.3	4.0	36.5-24.1	1,5

```
 43.5      3.0  36.5-23.4   4.0  36.0-23.0   0,0
 44.0      3.0  36.0-23.1   4.0  36.0-22.2   0,5
 44.5      3.0  35.5-22.4   4.0  36.0-21.7   0,5
 45.0      3.0  34.5-22.5   4.0  34.5-22.2   0,5
 45.5      3.0  34.5-23.1   4.0  35.0-22.2   0,5
 46.0      3.0  34.5-22.8   4.0  35.0-21.0   0,5
 46.5      3.0  33.5-22.0   4.0  34.5-20.8   1,0
 47.0      3.0  33.6-22.9   3.0  34.1-20.9   0,5
 47.5      3.0  34.5-22.0   4.0  33.0-22.0   2,0
 48.0      3.0  33.5-23.0   3.0  33.0-21.4   0,5
 48.5      3.0  32.6-21.5   3.0  32.6-20.4   0,0
 49.0      3.0  32.6-22.0   3.0  32.6-20.6   0,0
 49.5      3.0  31.6-21.6   3.0  32.6-20.9   0,5
 50.0      3.0  31.6-21.7   3.0  32.1-20.8   0,0
0.0      50.0       1.0
     MODEL  8/19                                          9.00    2      8
  416      -53.2          235          0.5          0,51
VER/VERT       101     0.0     50.0    0
HORIZ/HORIZ    101     0.0     50.0    0
  0.0       2.0  18.5-14.7   2.0  18.5-14.5   0,0
  0.5       2.0  18.5-15.6   2.0  18.5-15.1   0,5
  1.0       2.0  18.0-16.0   2.0  19.0-17.3   0,5
  1.5       2.0  19.0-16.5   2.0  18.0-20.6   0,5
  2.0       2.0  18.0-17.3   2.0  18.5-27.7   0,5
  2.5       2.0  19.0-20.2   1.0   0.0-23.4   0,5
  3.0       2.0  18.5-22.6   2.0  19.5-18.6   1,0
  3.5       2.0  18.5-26.4   2.0  18.5-15.5   0,0
  4.0       2.0  20.1-31.6   2.0  18.5-15.0   0,0
  4.5       2.0  18.0-38.2   2.0  18.0-14.9   1,0
  5.0       2.0  18.5-36.6   2.0  18.5-15.5   0,5
  5.5       2.0  19.0-30.4   2.0  18.0-16.9   0,5
  6.0       2.0  17.5-28.7   2.0  17.5-18.8   0,0
  6.5       2.0  17.5-29.7   2.0  18.0-19.6   0,0
  7.0       2.0  17.5-34.3   2.0  18.0-19.6  17,5
  7.5       2.0  17.4-35.0   1.0   0.0-15.3  18,5
  8.0       3.0  21.1-36.6   1.0   0.0-14.6  17,5
  8.5       2.0  20.0-38.7   2.0  17.5-14.2   2,5
  9.0       2.0  18.5-34.5   2.0  17.0-14.5   0,0
  9.5       3.0  18.5-30.8   2.0  18.0-15.3   0,5
 10.0       2.0  18.0-30.3   2.0  16.4-15.9   1,1
 10.5       3.0  18.5-34.3   2.0  18.0-15.6   0,0
 11.0       2.0  17.5-36.9   2.0  18.0-14.8   0,0
 11.5       2.0  16.9-38.7   2.0  18.0-14.8  17,5
 12.0       2.0  16.4-39.4   2.0  18.0-14.1   1,1
 12.5       2.0  18.0-35.4   1.0   0.0-14.3   0,0
 13.0       2.0  17.4-30.9   1.0   0.0-14.9   0,0
 13.5       2.0  15.5-30.8   2.0  16.5-15.3   0,0
 14.0       2.0  14.9-31.2   2.0  17.0-15.4   0,6
 14.5       3.0  19.6-34.5   2.0  15.9-14.8   0,6
 15.0       3.0  19.5-36.8   2.0  16.9-14.8   0,5
 15.5       3.0  20.6-37.4   2.0  16.9-15.2   0,0
 16.0       3.0  20.0-36.1   2.0  17.4-15.5   0,5
```

16.5	2.0	18.[illegible]-31.7	2.[illegible]	17.4-16.1	1,1
17.0	2.0	18.[illegible]-30.5	2.[illegible]	18.0-16.5	0,0
17.5	2.0	19.[illegible]-30.1	2.0	19.0-17.0	0,5
18.0	2.0	18.5-34.4	2.[illegible]	18.5-17.0	0,5
18.5	2.0	18.5-36.0	2.[illegible]	15.4-16.7	0,0
19.0	3.0	24.2-35.6	2.[illegible]	15.4-17.2	0,0
19.5	2.0	18.5-35.1	2.[illegible]	15.9-17.7	0,0
20.0	2.0	18.[illegible]-34.5	2.[illegible]	15.9-17.6	0,0
20.5	2.0	16.9-31.1	2.[illegible]	17.4-17.2	0,0
21.0	2.0	16.4-30.5	2.[illegible]	17.4-16.7	1,0
21.5	2.0	17.5-29.6	2.[illegible]	17.5-16.2	0,0
22.0	2.0	16.9-29.6	2.0	16.9-16.2	0,0
22.5	2.0	16.4-29.6	2.[illegible]	17.5-15.7	0,0
23.0	2.0	17.[illegible]-29.0	2.[illegible]	17.5-15.6	0,5
23.5	2.0	16.9-28.4	2.[illegible]	18.0-15.2	0,0
24.0	2.0	16.9-28.2	1.[illegible]	0.0-15.2	0,0
24.5	2.0	17.[illegible]-27.3	2.[illegible]	17.0-15.2	0,0
25.0	2.0	17.5-27.4	2.[illegible]	17.5-15.2	0,0
25.5	2.0	17.5-26.9	2.[illegible]	16.4-15.0	0,0
26.0	2.0	16.4-26.7	2.[illegible]	16.4-15.0	0,0
26.5	2.0	16.5-26.4	2.[illegible]	16.4-15.3	0,5
27.0	2.0	16.4-26.5	2.[illegible]	17.5-15.4	0,5
27.5	2.0	16.4-25.7	2.[illegible]	16.5-15.3	0,5
28.0	2.0	16.5-26.0	2.[illegible]	16.5-15.7	0,0
28.5	2.0	15.9-25.3	2.[illegible]	17.5-15.4	0,5
29.0	2.0	16.5-24.7	2.[illegible]	17.0-15.9	0,0
29.5	2.0	16.5-24.4	2.[illegible]	17.0-16.1	0,0
30.0	2.0	15.9-24.2	2.[illegible]	16.5-16.2	0,0
30.5	2.0	16.[illegible]-23.9	2.[illegible]	16.5-16.1	0,5
31.0	2.0	15.4-23.4	2.[illegible]	15.4-15.7	0,5
31.5	2.0	17.[illegible]-23.[illegible]	2.[illegible]	15.9-15.5	0,0
32.0	2.0	14.9-23.1	2.[illegible]	15.4-15.5	0,5
32.5	2.0	14.9-23.[illegible]	2.[illegible]	16.0-15.2	0,5
33.0	2.0	14.9-22.9	2.[illegible]	15.9-15.1	1,0
33.5	2.0	15.5-22.4	2.[illegible]	16.0-15.3	0,5
34.0	2.0	14.9-21.8	2.[illegible]	15.4-15.4	0,0
34.5	2.0	15.4-22.1	2.[illegible]	17.0-15.1	0,5
35.0	2.0	14.9-21.5	2.[illegible]	15.4-15.7	0,5
35.5	2.0	16.[illegible]-20.9	2.[illegible]	15.4-15.7	0,0
36.0	2.0	15.5-20.7	2.[illegible]	15.4-15.8	0,5
36.5	2.0	15.5-20.3	2.[illegible]	14.3-15.7	0,6
37.0	2.0	14.4-20.[illegible]	2.[illegible]	14.9-15.5	0,0
37.5	2.0	14.3-19.6	2.[illegible]	14.4-16.[illegible]	0,6
38.0	2.0	13.8-19.8	2.[illegible]	14.4-15.5	0,5
38.5	2.0	13.8-19.3	2.[illegible]	14.9-15.7	0,0
39.0	2.0	14.3-19.1	2.[illegible]	14.9-15.8	0,5
39.5	2.0	14.3-18.5	2.[illegible]	13.8-15.6	0,0
40.0	2.0	15.4-18.1	2.[illegible]	14.4-15.5	0,5
40.5	2.0	14.3-18.2	2.[illegible]	14.4-15.6	0,5
41.0	2.0	15.4-18.[illegible]	2.[illegible]	14.9-15.9	1,0
41.5	2.0	14.9-18.[illegible]	2.[illegible]	13.8-16.[illegible]	0,0
42.0	2.0	14.3-17.1	2.[illegible]	14.3-16.3	0,0

42.5	2.0	13.8-17.0	2.0	13.8-16.5	0.5
43.0	2.0	13.8-16.8	2.0	13.8-15.7	0.0
43.5	2.0	13.8-16.6	2.0	13.8-16.0	0.0
44.0	2.0	13.8-16.6	2.0	13.9-16.4	0.5
44.5	2.0	12.8-16.5	2.0	13.8-16.1	0.5
45.0	2.0	13.3-16.4	2.0	13.3-16.6	0.0
45.5	2.0	13.8-15.8	2.0	13.9-16.5	0.5
46.0	2.0	13.8-15.8	2.0	13.3-16.4	0.5
46.5	2.0	13.9-15.6	2.0	13.3-17.4	0.0
47.0	2.0	13.3-15.6	2.0	13.3-17.3	0.0
47.5	2.0	12.8-15.1	2.0	12.8-17.7	0.0
48.0	2.0	12.8-14.8	2.0	12.8-17.4	0.5
48.5	2.0	12.8-15.5	2.0	12.8-17.7	0.0
49.0	2.0	12.8-15.2	2.0	12.3-18.3	0.5
49.5	2.0	12.8-15.1	2.0	12.9-18.9	1.5
50.0	2.0	12.8-14.8	2.0	12.3-18.9	0.5
100	50.0	1.0			
	MODEL	66			9.00 2 20
393	-55.9	203	0.5		0.49
VERT/VERT	101	0.0	50.0	0	
HORIZ/HORIZ	101	0.0	50.0	0	
0.0	2.0	7.9-22.8	2.0	6.9-22.4	1.0
0.5	2.0	7.9-22.8	2.0	7.9-22.7	0.0
1.0	2.0	7.4-22.7	2.0	7.4-23.5	0.0
1.5	2.0	7.4-24.0	2.0	7.9-25.1	0.5
2.0	2.0	7.9-24.7	2.0	6.9-27.3	1.0
2.5	2.0	7.9-26.1	2.0	7.9-26.9	8.4
3.0	2.0	7.9-26.8	3.0	11.4-27.1	7.4
3.5	2.0	7.9-28.0	3.0	10.4-27.4	0.0
4.0	2.0	7.9-27.0	2.0	7.9-28.1	0.5
4.5	2.0	7.9-28.0	2.0	7.9-26.8	7.4
5.0	2.0	7.9-28.2	2.0	7.9-24.9	7.9
5.5	2.0	9.9-26.7	2.0	7.4-23.8	7.9
6.0	2.0	11.4-27.9	2.0	7.9-24.1	8.9
6.5	2.0	9.9-28.3	2.0	7.9-23.9	7.4
7.0	2.0	10.4-27.6	2.0	7.9-24.7	7.9
7.5	2.0	9.4-28.0	2.0	7.4-26.6	6.4
8.0	2.0	8.9-27.3	2.0	7.9-27.4	1.0
8.5	2.0	9.4-28.0	2.0	7.0-27.5	0.5
9.0	2.0	9.9-27.8	2.0	7.0-27.5	0.0
9.5	2.0	10.4-27.8	2.0	6.5-27.9	1.0
10.0	2.0	10.9-28.1	2.0	7.0-27.2	0.0
10.5	2.0	11.9-27.8	2.0	7.4-26.9	1.0
11.0	2.0	8.9-27.4	2.0	7.0-26.8	1.0
11.5	2.0	10.9-27.7	2.0	7.5-27.0	0.5
12.0	2.0	10.4-27.6	2.0	7.0-26.6	1.0
12.5	2.0	9.9-28.1	2.0	7.0-26.6	0.0
13.0	2.0	10.4-28.0	2.0	6.4-26.6	1.0
13.5	2.0	10.4-27.8	2.0	6.0-26.5	0.5
14.0	2.0	12.4-27.2	2.0	6.5-26.5	0.5
14.5	2.0	11.9-28.0	3.0	11.9-26.3	0.0
15.0	2.0	10.9-28.0	3.0	11.4-27.0	0.0

15.5	2.0	11.4-27.7	3.0	10.9-26.3	1,0
16.0	2.0	10.4-27.6	2.0	6.5-27.3	0,5
16.5	2.0	11.4-27.7	2.0	6.0-27.0	1,0
17.0	3.0	10.4-28.0	2.0	6.0-27.2	0,5
17.5	2.0	10.9-28.3	2.0	6.0-27.5	0,0
18.0	2.0	9.4-28.0	2.0	6.5-27.5	0,5
18.5	2.0	10.4-28.3	2.0	6.5-27.3	1,0
19.0	2.0	9.4-27.5	2.0	6.0-27.4	1,0
19.5	2.0	8.4-28.2	2.0	6.0-27.1	0,5
20.0	2.0	9.4-27.9	2.0	6.0-26.3	0,0
20.5	2.0	10.4-27.8	2.0	6.5-27.5	0,5
21.0	2.0	11.4-27.5	2.0	6.5-26.6	0,0
21.5	2.0	9.4-27.7	2.0	6.5-26.7	0,5
22.0	2.0	9.9-28.1	2.0	6.0-26.5	0,0
22.5	2.0	9.9-28.5	2.0	6.0-26.5	0,5
23.0	2.0	9.9-27.5	2.0	6.0-27.2	0,5
23.5	2.0	8.4-27.7	2.0	6.0-27.5	0,0
24.0	2.0	9.9-28.3	2.0	6.0-27.3	0,5
24.5	2.0	9.9-28.0	1.0	0.0-27.5	0,0
25.0	2.0	10.9-27.5	2.0	6.0-27.1	0,5
25.5	2.0	9.9-28.0	2.0	10.9-26.3	1,0
26.0	2.0	10.4-28.1	3.0	10.9-26.3	0,5
26.5	2.0	10.9-27.8	1.0	0.0-25.8	0,5
27.0	2.0	10.4-27.5	2.0	10.9-26.3	0,0
27.5	2.0	9.9-27.3	3.0	8.9-26.0	1,0
28.0	2.0	9.4-26.8	2.0	5.0-26.8	0,5
28.5	2.0	8.4-27.7	2.0	5.5-26.2	1,0
29.0	2.0	10.4-26.7	2.0	5.0-26.3	1,0
29.5	2.0	10.9-27.6	2.0	5.0-26.6	1,5
30.0	2.0	10.4-26.8	2.0	5.0-26.1	0,5
30.5	2.0	10.4-26.4	2.0	5.0-27.4	1,5
31.0	2.0	10.9-26.7	2.0	5.0-26.8	0,5
31.5	2.0	9.9-26.8	1.0	0.0-26.7	1,0
32.0	2.0	9.9-26.6	1.0	0.0-26.4	0,5
32.5	2.0	10.4-26.0	1.0	0.0-25.5	0,5
33.0	2.0	8.9-26.2	1.0	0.0-25.0	1,0
33.5	1.0	0.0-25.6	1.0	0.0-24.4	1,5
34.0	2.0	9.4-26.4	1.0	0.0-24.6	0,0
34.5	1.0	0.0-26.1	1.0	0.0-24.7	0,5
35.0	1.0	0.0-25.6	2.0	5.5-24.6	0,0
35.5	1.0	0.0-26.1	2.0	3.5-25.1	0,5
36.0	1.0	0.0-26.2	2.0	5.0-26.2	0,0
36.5	1.0	0.0-26.6	2.0	4.5-25.2	0,5
37.0	1.0	0.0-25.1	1.0	0.0-25.8	0,5
37.5	1.0	0.0-25.5	1.0	0.0-24.0	1,0
38.0	1.0	0.0-25.7	1.0	0.0-23.9	0,5
38.5	1.0	0.0-24.8	1.0	0.0-23.4	0,5
39.0	1.0	0.0-25.2	1.0	0.0-23.5	0,0
39.5	1.0	0.0-25.2	1.0	0.0-23.9	1,0
40.0	1.0	0.0-25.1	1.0	0.0-23.5	0,5
40.5	1.0	0.0-25.9	1.0	0.0-24.2	1,0
41.0	1.0	0.0-26.0	2.0	4.5-25.3	1,0

41.5		1.0	0.0-25.8	2.0	4.0-25.1	0,0
42.0		1.0	0.0-25.4	1.0	0.0-25.3	1,5
42.5		1.0	0.0-25.6	1.0	0.0-23.6	0,0
43.0		1.0	0.0-24.6	1.0	0.0-23.9	0,5
43.5		1.0	0.0-24.9	1.0	0.0-22.4	0,5
44.0		1.0	0.0-24.2	1.0	0.0-22.2	2,0
44.5		1.0	0.0-23.2	1.0	0.0-21.5	1,0
45.0		1.0	0.0-22.8	1.0	0.0-21.9	1,0
45.5		1.0	0.0-23.4	1.0	0.0-22.1	0,0
46.0		1.0	0.0-22.7	1.0	0.0-20.9	0,0
46.5		1.0	0.0-23.1	1.0	0.0-21.7	0,0
47.0		1.0	0.0-23.7	1.0	0.0-22.0	0,0
47.5		1.0	0.0-22.3	1.0	0.0-22.5	0,5
48.0		1.0	0.0-22.6	1.0	0.0-21.6	0,5
48.5		1.0	0.0-23.6	1.0	0.0-20.8	0,0
49.0		1.0	0.0-22.7	1.0	0.0-21.3	0,5
49.5		1.0	0.0-21.8	1.0	0.0-21.6	0,0
50.0		1.0	0.0-21.7	1.0	0.0-20.5	1,0
2	1	1	1			
2	1	1				
2		1	1			

MISSION
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